GENERAL SERVICES ADMINISTRATION
CONTRACT NUMBER GS-10F-0076K
DELIVERY ORDER NUMBER 62474-03-F-4015

Data Gap Sampling and Analysis Plan (Field Sampling Plan/Quality Assurance Project Plan) Tidal Area Sites 2, 9, and 11

Naval Weapons Station Seal Beach Detachment Concord Concord, California

GSA.0106.0013

DRAFT

July 13, 2004

Naval Facilities Engineering Command

Department of the Navy
Engineering Field Activity West
Daly City, California

TETRA TECH, INC.

GENERAL SERVICES ADMINISTRATION
Contract Number: GS-10F-0076K
Delivery Order: N62474-03-F-4015
GSA.0106.0013

Draft

Data Gaps Sampling and Analysis Plan
(Field Sampling Plan/Quality Assurance Project Plan)
Tidal Area Sites 2, 9, and 11

Naval Weapons Station Seal Beach Detachment Concord
Concord, California

July 13, 2004

Prepared for

NAVFAC
Naval Facilities Engineering Command

DEPARTMENT OF THE NAVY
Engineering Field Activity West
Daly City, California

Prepared by

TETRA TECH EM INC.
135 Main Street, Suite 1800
San Francisco, California 94105
(415) 543-4880

for **John Bosche, P.E., Project Manager**

Draft

Data Gaps Sampling and Analysis Plan
(Field Sampling Plan and Quality Assurance Project Plan)
Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord
Concord, California

Contract Number: GS-10F-0076K

Delivery Order: N62474-03-F-4015

PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Tetra Tech Program QA Manager: ______________________ for
Greg Swanson, Tetra Tech
Date: 13 July 04

Navy QA Officer: ______________________
Narciso A. Ancog
Date: 7/13/04

DISTRIBUTION LIST

Name	Responsibility	Affiliation
Steve Tyahla	Remedial Project Manager	Engineering Field Activity West Naval Facilities Engineering Command
Narciso A. Ancog	Quality Assurance (QA) Officer	Naval Facilities Engineering Command, Southwest Division
Phillip Ramsey	Project Manager	U.S. Environmental Protection Agency Region 9
Jim Pinasco	Project Manager	California Environmental Protection Agency Department of Toxic Substances Control
Laurent Meillier	Project Manager	California Regional Water Quality Control Board, San Francisco Bay Region
Greg Swanson	Program QA Manager	Tetra Tech EM Inc.
Ron Ohta	Project QA Officer	Tetra Tech EM Inc.
John Bosche	Project Manager	Tetra Tech EM Inc.
Sara Woolley	Analytical Coordinator	Tetra Tech EM Inc.
To be determined	Field Team Leader	Tetra Tech EM Inc.

TABLE 1: ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

	EPA QA/R-5 QAPP ELEMENT[a]		Tetra Tech SAP
A1	Title and Approval Sheet		Title and Approval Sheet
A2	Table of Contents		Table of Contents
A3	Distribution List		Distribution List
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Problem Definition and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Non-direct Measurements	2.9	Nondirect Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods		
D3	Reconciliation with User Requirements	4.2	Reconciliation with User Requirements

Notes:

a EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

EPA U.S. Environmental Protection Agency
QAPP Quality assurance project plan
SAP Sampling and analysis plan
Tetra Tech Tetra Tech EM Inc.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

Appendix

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

µg/kg	Micrograms per kilogram
%R	Percent recovery
1927 NAD	1927 North American Datum
1929 NGVD	1929 National Geodetic Vertical Datum
AA	Atomic absorption
ags	Above ground surface
ASTM	ASTM International (formerly the American Society for Testing and Materials)
AWQC	Ambient Water Quality Criterion
BERA	Baseline ecological risk assessment
bgs	Below ground surface
C	Centigrade
CLP	Contract laboratory program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Contaminant of potential concern
CPR	Cardiopulmonary resuscitation
CS	Confirmation study
DDT	Dichlorodiphenyltrichloroethane
DHS	Department of Health Services
DO	Delivery Order
DQA	Data quality assessment
DQO	Data quality objective
DTSC	Department of Toxic Substances Control
E&E	Ecology and Environment
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ER	Equipment rinsate
ER-M	Effects range-median
FTL	Field team leader
GC/MS	Gas chromatography/mass spectrometry
GFAA	Graphite furnace atomic absorption
GIS	Geographic information system
GPC	Gel permeation chromatography

ACRONYMS AND ABBREVIATIONS (Continued)

HASP	Health and safety plan
IAS	Initial assessment study
ID	Identification
IDL	Instrument detection limit
IDW	Investigation-derived waste
ICP	Inductively coupled plasma
IR	Installation restoration
IRCDQM	Installation Restoration Chemical Data Quality Manual
LEL	Lower explosive limit
LCS	Laboratory control sample
LIMS	Laboratory information management system
MCAWW	Methods for Chemical Analysis of Water and Waste
MDL	Method detection limit
MEC	Munitions and explosives of concern
mg/kg	Milligrams per kilogram
mL	Milliliter
mg/m^3	Milligrams per cubic meter
MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
MSR	Monthly status report
NAVFAC	Naval Facilities Engineering Command
NEDTS	Navy Environmental Data Transfer Standards
NFESC	Naval Facilities Engineering Service Center
NWS	Naval Weapons Station
OEW	Ordnance and explosive waste
OHSO	On-site health and safety officer
OSHA	Occupational Safety and Health Administration
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyls
PCP	Pentachlorophenol
PE	Performance evaluation
PELs	Permissible exposure limits
PPE	Personal protective equipment
ppm	Parts per million
ppt	Parts per thousand

ACRONYMS AND ABBREVIATIONS (Continued)

PRC	PRC Environmental Management, Inc.
PRRL	Project-required reporting limit
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QCSR	Quality control summary report
RCRA	Resource Conservation and Recovery Act
RFA	RCRA facility assessment
RI	Remedial investigation
RPD	Relative percent difference
RPM	Remedial project manager
SAP	Sampling and analysis plan
SBD	Seal Beach Detachment
SDG	Sample delivery group
SI	Site investigation
SOP	Standard operating procedure
SOW	Statement of work
SQL	Sample quantitation limit
SSC	Site safety coordinator
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TDS	Total dissolved solids
Tetra Tech	Tetra Tech EM Inc.
TIC	Tentatively identified compound
TLV	Threshold limit value
TOC	Total organic carbon
TSA	Technical systems audit
TSS	Total suspended solids
VOC	Volatile organic compound

1.0 PROJECT DESCRIPTION AND MANAGEMENT

Tetra Tech EM Inc. (Tetra Tech) plans to collect soil and groundwater samples within Tidal Area Sites 2, 9, and 11 to fill data gaps that were identified after the Draft Remedial Investigation (RI) dated August 8, 2003, was completed (Tetra Tech 2003). Site 2, the R Area; Site 9, the Froid and Taylor Roads Site; and Site 11, the Wood Hogger Site are located at Naval Weapons Station (NWS) Seal Beach Detachment (SBD) Concord. The location of Naval Weapons Station SBD Concord is illustrated on the site vicinity map, Figure 1. A more detailed site plan that illustrates the extent of Sites 2, 9, and 11 in the Tidal Area is presented on Figure 2.

After the state and federal regulatory agencies had reviewed the draft RI report, the Navy agreed to fill data gaps identified and revise the RI. Tetra Tech therefore prepared this sampling and analysis plan (SAP) to guide the field, laboratory, and data reporting efforts associated with this project.

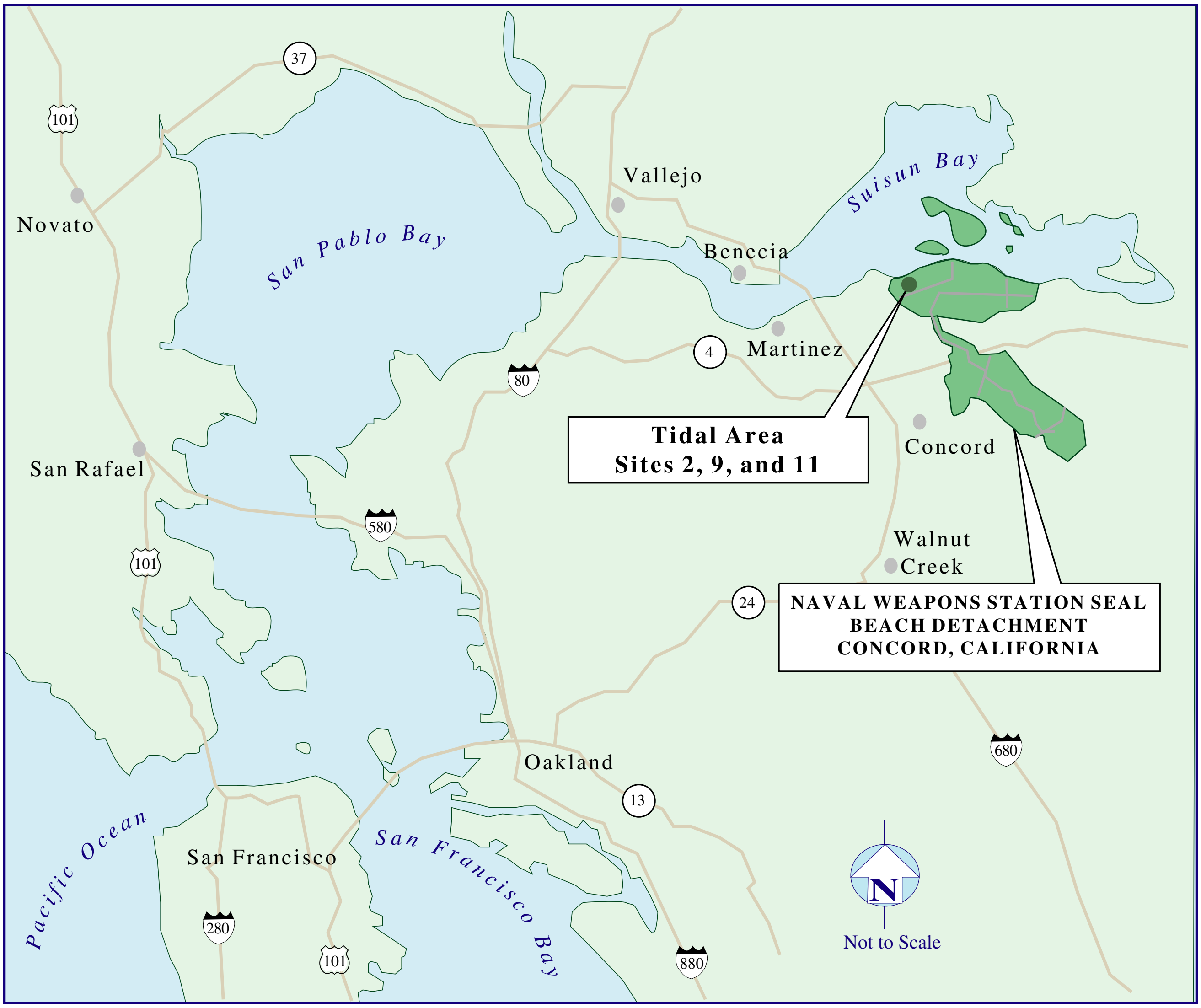
Table 1 follows the approval page at the beginning of this SAP. The table demonstrates how this SAP addresses all the elements of a quality assurance project plan (QAPP) required by the U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document (EPA 2001).

Tables and figures follow their first reference in the text in this document. The following appendices are included with this SAP. Appendix A lists project-required reporting limits; Appendix B contains method precision and accuracy goals; Appendix C presents the site-specific health and safety plan (HASP); Appendix D contains all field forms; Appendix E contains Tetra Tech Standard Operating Procedures (SOP), Appendix F contains an example chain-of-custody form, and Appendix G lists approved laboratories that Tetra Tech has contracted to analyze samples collected under Navy contracts.

1.1 PROBLEM DEFINITION AND BACKGROUND

This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Facility Background (Section 1.1.3)
- Site Description (Section 1.1.4)
- Physical Setting (Section 1.1.5)
- Summary of Previous Investigations (Section 1.1.6)
- Principal Decision-Makers (Section 1.1.7)
- Technical or Regulatory Standards (Section 1.1.8)



Tetra Tech EM Inc.

Naval Weapons Station Seal Beach Detachment
Concord, California
EFA West, Daly City

FIGURE 1
SITE VICINITY MAP

Tidal Area Data Gap Investigation SAP

Figure 2

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.

1.1.1 Purpose of the Investigation

The purpose of the additional investigation at Sites 2, 9, and 11 is to close two data gaps identified after the Revised Draft Final RI dated August 8, 2003, was completed (Tetra Tech 2003).

1.1.2 Problem to be Solved

The two data gaps identified after the RI was completed are described in the following sections.

1.1.2.1 Pesticides in Sediment at Site 9

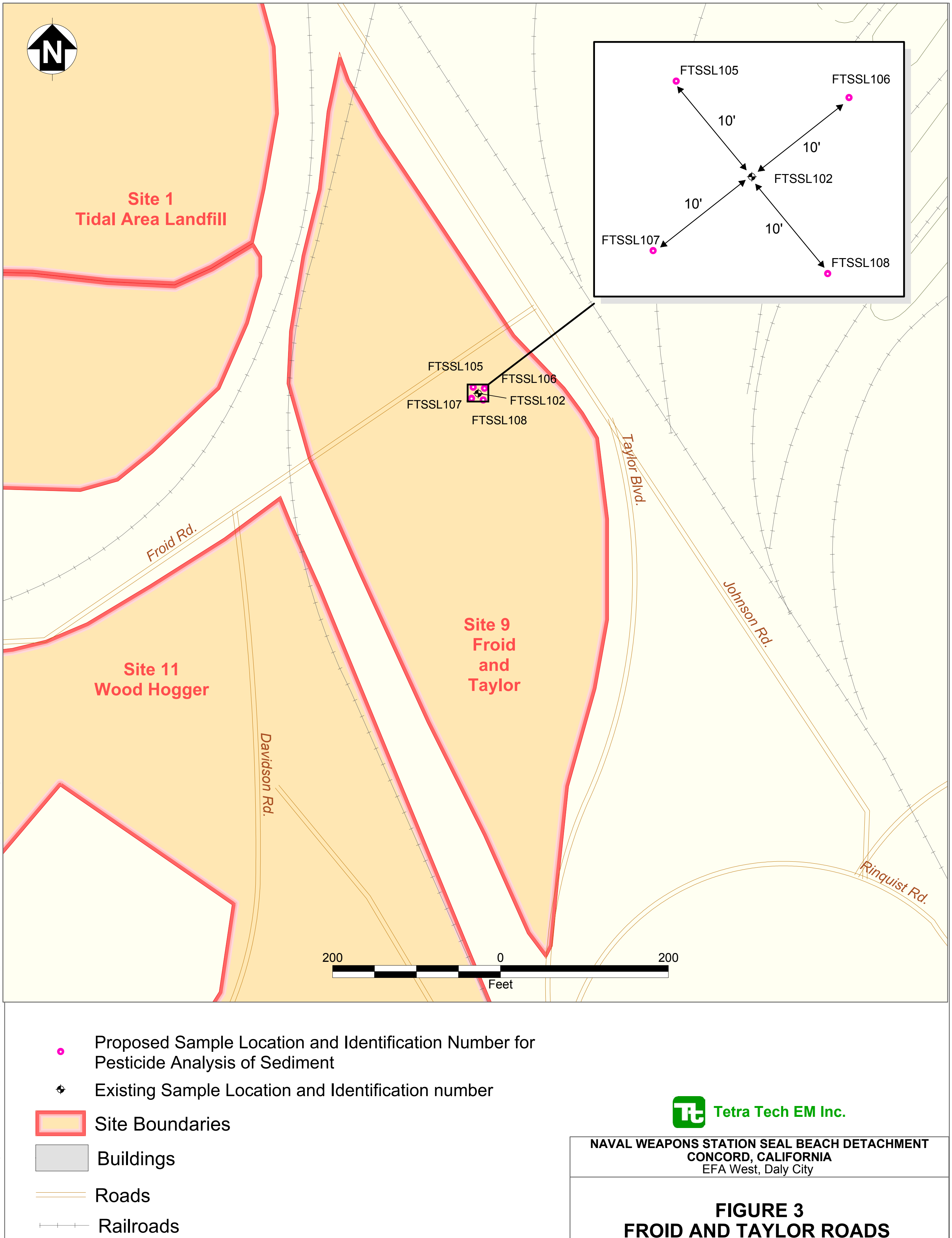
Three pesticides (alpha chlordane, gamma chlordane, and dichlorodiphenyltrichloroethane [DDT]) were detected at concentrations above the effects range-median (ER-M) (Long 1990, Long 1995, and Long 1998), at location FTSSL102, which resulted in calculation of an ER-M quotient (ER-M_q) of 0.63 at that location. The ER-M_q was categorized in the baseline ecological risk assessment as a "medium high" priority level. All other calculated ER-M_qs for Froid and Taylor Roads sediment were categorized as "lowest" or "medium to lowest" priority. The conclusion of the baseline ecological risk assessment (BERA) was that the distribution of ER-M_qs across the site indicates little risk to populations of benthic invertebrates at Site 9.

The mean ER-M_q takes into account the additive effect of exposure to chemical mixtures and provides a standard by which to measure the cumulative effect of chemical mixtures on benthic invertebrates; its applicability to fishes is unknown. The mean ER-M_q is calculated by dividing the sum of the HQs of individual chemicals in a sample by the number of chemicals. Sites with a mean ER-M_q greater than 1.5 were classified as highest priority for risk based on potential toxicity. Sites with a mean ER-M_q between 0.51 and 1.5 were classified as medium to high priority sites, and sites with mean ER-M_qs between 0.11 and 0.50 were considered medium to low priority sites.

EPA suggested that further investigations or remedial actions, such as hot spot removal, are warranted at location FTSSL102 to address potential risk to benthic invertebrates at that location. The Navy proposes collection of four step-out confirmation surface sediment samples at FTSSL102 to evaluate the presence of pesticides in sediment at FTSSL102. Constituent analysis will consist of pesticides. The locations of the four step-out samples are illustrated on Figure 3.

1.1.2.2 Mercury in Sediment at Site 11

As reported in the BERA, the maximum concentrations of mercury detected at the site (from location WHSSB022) resulted in a calculation of a hazard quotient of 26.0. This location had an overall ER-M quotient (ER-M_q) of 2.75 which is considered a "high" priority level. Mercury concentrations at three other locations within the south west corner of the site exceeded the ER-M for mercury (218 mg/kg), but none of those locations had an ER-Mq of high priority.



Tetra Tech EM Inc.

NAVAL WEAPONS STATION SEAL BEACH DETACHMENT
CONCORD, CALIFORNIA
EFA West, Daly City

FIGURE 3
FROID AND TAYLOR ROADS SITE SAMPLES

Tidal Area Data Gaps Investigation SAP

2004-06-22 V:\Concord\Projects\Tidal_GW_Invest\Froid_Taylor_Rd_smples.mxd TtEMI-SF Michelle Angeles

None of the 14 sediment samples from Otter Sluice were designated as highest priority based on ER-M_qs. Twelve samples (86 percent) were medium to low priority, and two samples were medium to high priority. In all samples, nickel was the only detected chemical that exceeded the ER-M; all other concentrations included in the ER-M_q were based on substituting one-half the detection limit for nondetected data. These data indicate *de minimis* risk to benthic invertebrates in Otter Sluice.

There is uncertainty associated with the extent and risk posed by mercury at the Wood Hogger Site because detection limits achieved for surface water samples were above the Ambient Water Quality Criterion (AWQC) and the concentrations of mercury in sediment were highly variable. The highest concentration of mercury in sediment was detected at sample location WHSSB022 (18.5 milligrams per kilogram [mg/kg]). A sample collected adjacent to that location (WHSSBA08) showed a result for mercury of 0.44 mg/kg. The 50-fold differential between these adjacent samples illustrates the variability of sample results in the southwestern corner of the site, where the highest concentration of mercury was detected. Mercury concentrations were below ecological benchmarks within Otter Sluice, suggesting that sediments contaminated with mercury are not generally mobile in the area.

The BERA concluded that the distribution of ER-M_qs across the site indicates little risk to populations of benthic invertebrates or aquatic organisms at Site 11. However, because mercury bioaccumulates and biomagnifies, additional investigation of the nature and extent of mercury in this area is warranted.

Sampling to date suggests that elevated concentrations of mercury occur at several locations at the southwestern corner of Site 11 and that the concentrations of mercury in soils and sediments may be highly variable. The Navy plans to collect additional data to address the variability of mercury concentrations and to better characterize the general area of relatively high mercury concentrations. The intent of the additional sampling is not only to evaluate the existing conditions, but also to prepare for remedial actions, if required, by thorough characterization of the nature and extent of mercury contamination.

The Navy will establish transects extending from one side of Otter Sluice to the other. Soil and sediment samples will be collected from Otter Sluice and from the adjoining embankments. Nine transect lines will be spaced 100 feet on center, measured along the length of Otter Sluice near the southwestern corner of Site 11. Up to nine samples will be collected along the length of each transect. Refer to Figure 4 for an illustration of the plan view of transects numbered 1 through 9 and to Figure 5 for a schematic cross sectional view of the sample locations on each transect. The sample locations illustrated on Figure 5 are schematic and are not drawn to scale. Actual sample locations will be adjusted to accommodate existing physical features of Otter Sluice and the adjoining embankments; the schematic illustration will serve as a guide to locating samples in the field. Each transect will include two samples west or south of Otter Sluice at distances of approximately 20 feet from the sluice; three samples from the bottom of Otter Sluice, and four samples east or north of Otter Sluice. Each sample location will be surveyed to determine horizontal position (x and y coordinates) and elevation (z coordinate). Figure 5 shows approximate target distances for sample collection.

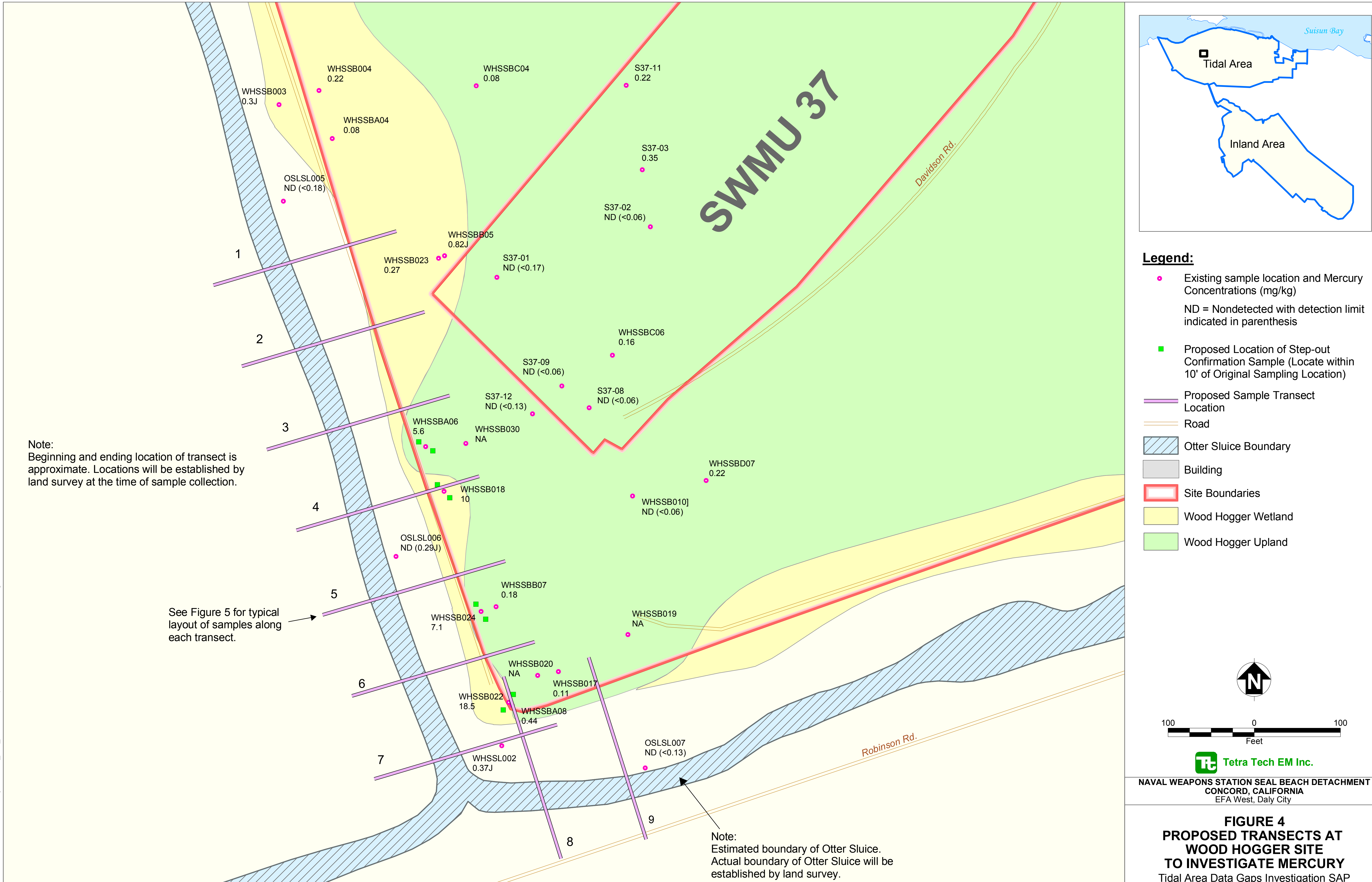
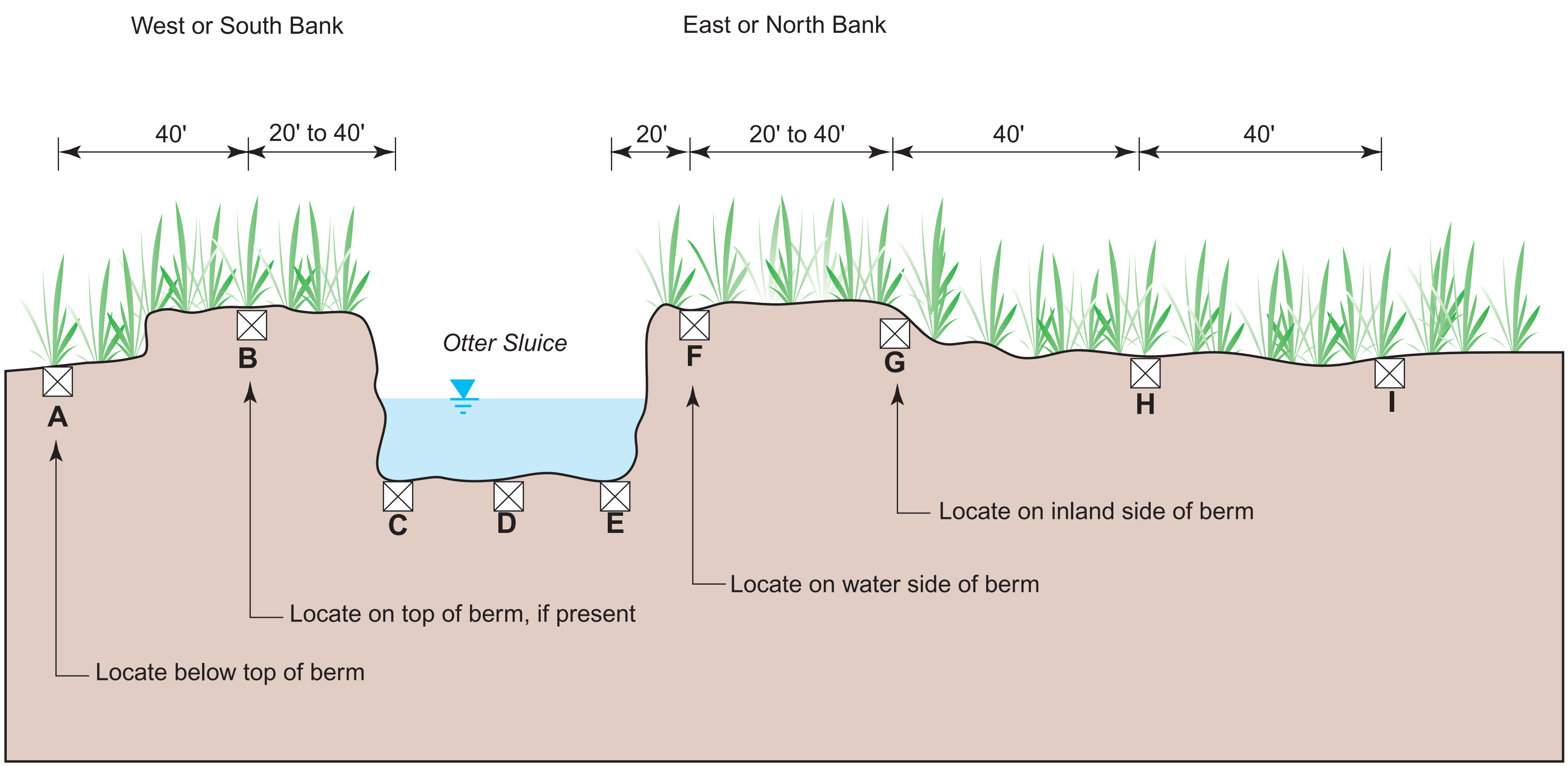


FIGURE 4
PROPOSED TRANSECTS AT WOOD HOGGER SITE TO INVESTIGATE MERCURY
Tidal Area Data Gaps Investigation SAP

2004-07-09 V:\Concord\Projects\Tidal_GW_Invest\basemap.mxd TtEMI-SF Michelle Angeles



☒ Approximate proposed surface soil or sediment sample location for mercury analysis. Actual locations will be determined in the field based upon topography and with the goal of collecting representative samples.

Schematic only - Not to Scale
Actual configuration of Otter Sluice Channel and berms will be established by a land surveyor during the field work.

Tetra Tech EM Inc.

Naval Weapons Station Seal Beach Detachment
Concord, California
EFA West, Daly City

FIGURE 5
WOOD HOGGER SITE SAMPLE LOCATIONS ON TYPICAL TRANSECT
Tidal Area Data Gaps Investigation SAP

In addition to sampling along the nine transects, samples will be collected near the three sample locations at the southwestern corner of the site where concentrations of mercury exceeded the ER-M. These samples will be used to assess the variability of mercury concentrations in soil in this area. The Navy plans to collect two step-out confirmation samples within 1 horizontal foot of the following locations; the concentration of mercury in the original sample is provided in parentheses:

- WHSSB022 (18.5 mg/kg)
- WHSSB018 (10 mg/kg)
- WHSSBA06 (5.6 mg/kg)

All transect samples and step-out samples will be collected at the surface (0 to 0.5 feet below ground surface [bgs] or at the mudline). Constituent analysis will consist of mercury. All mercury detected will be assumed to be methylated, precluding the need for specific analysis of methylmercury.

Since the most recent meeting with the regulatory agencies, the Navy has verified that the location of all previous soil and sediment samples was established using land surveying techniques and that the locations of the samples are accurately depicted on the map. During the meeting with the agencies on May 14, 2002; however, the accuracy of the RI map that depicts the location and configuration of Otter Sluice was called into question. The Navy's review of the map could not confirm it's accuracy regarding the location of Otter Sluice. Thus, confirming or identifying the accurate location of Otter Sluice on the RI site plans remains a data gap. The Navy plans to address the data gap using a land surveyor to establish the location of the east/west and north/south banks of Otter Sluice and the topography in the general area. The surveyor will also be responsible to establish an accurate horizontal location and ground surface elevation of all soil sampling points.

1.1.3 Facility Background and Setting

Naval Weapons Station SBD Concord is located in the north-central portion of Contra Costa County, California, about 30 miles northeast of San Francisco. The facility, which encompasses about 13,000 acres, is bounded by Suisun Bay to the north and by the City of Concord to the south and west (see Figure 1). Currently, the facility contains two main land holdings: the Tidal Area and the Inland Area.

Land use in the vicinity of Naval Weapons Station SBD Concord is diverse, characterized by a mixture of industrial and residential areas, rangeland, and open space. The Navy retains ownership of the Tidal Area; however, as of 1999, an indefinite use permit has been issued that allows the U.S. Army to conduct operations in the area. The U.S. Army currently manages munitions and equipment loading there.

Naval Weapons Station SBD Concord is a major explosive ordnance transshipment facility, providing storage, maintenance, and technical support for ordnance operations.

1.1.4 Site Descriptions

The following sections provide a physical description of Sites 9 and 11 where data gaps have been identified.

1.1.4.1 Site 9, Froid and Taylor Roads Site

The Froid and Taylor Roads Site consists of an area about 800 by 300 feet that is bisected by Froid Road (see Figure 2). The site is bordered by Taylor Boulevard on the east, the Wood Hogger site on the southwest, and an unnamed dirt and asphalt road on the northwest. Within Site 9, a small, upland area north of Froid Road is vegetated by nonnative grasses. The area south of Froid Road contains a ponded area surrounded by a small wetland, which is the remnant channel of Otter Sluice before it was channelized by the Navy in the 1940s. This site receives tidal inflow only during very high tides, followed by a gradual decrease in surface water and an increase in salinity (to more than 50 parts per thousand [ppt] in July 1994) through evaporation. High turbidity and low dissolved oxygen are typical of late summer periods of drydown (Western Ecological Services Company [WESCO] 1995). This section presents a brief history of operations at the Froid and Taylor Roads Site.

The Froid and Taylor Roads Site has changed significantly from 1939 to the present, with development of Naval Weapons Station SBD Concord. Aerial photographs taken in 1939 indicate little activity in the vicinity of the Froid and Taylor Roads Site. By 1950, the site was encompassed by Taylor and Froid Roads. One small road that passed through the Froid and Taylor Roads Site is apparent from 1950 aerial photographs and can still be observed on the site. The natural slough that once passed through the Tidal Area sites was partially filled near the Froid and Taylor Roads to construct roads and buildings. A curved portion of the slough can still be seen, and a maximum tidal fluctuation of 2 inches was measured during the tidal influence study conducted in July 1994.

During the initial assessment study (IAS), a piece of ordnance was found on the shoulder of Froid Road, near its intersection with Taylor Boulevard. Explosive ordnance disposal personnel later identified this piece of ordnance as a spent, 5-inch, white phosphorus rocket round. An investigation of the surrounding area revealed scrap metal and other debris in the area south of the intersection of the two roads. The IAS also noted that the site was subject to tidal action; however, it presented no information to justify this statement. Although no specific incidents of hazardous materials disposal were linked directly to this site, its proximity to the other sites made it an area of concern during the IAS (E&E 1983).

During the RI, pesticides were detected at sample location FTSSL102 at concentrations that exceeded ER-M values. Details on the pesticides detected at location FTSSL102 are presented in Section 1.1.2.1.

1.1.4.2 Site 11, Wood Hogger Site

The Wood Hogger Site is bordered by Otter Sluice to the west and south, by Froid Road to the north, and by an unnamed dirt and asphalt road to the east. The center of the Wood Hogger site is a rectangular, paved and unvegetated area surrounded by upland habitat. Emergent wetland habitat occurs at the border of the Wood Hogger Site, with Otter Sluice to the west and south. Areas of ponded surface water occur intermittently in the southern portion of the site, generally after heavy rains that coincide with high tides. Large areas in the Wood Hogger Site were previously filled with silty clay, sands, and other fill materials. The yard is not now actively used. In the recent past, it was used on an intermittent basis as a storage yard for scrap metal, wood, and portable wood chipping machinery (wood hoggers).

Historically, the Wood Hogger Site has been used as a dunnage and scrap wood area. Aerial photographs from 1939, before the Navy owned the land, indicate little activity in the present Wood Hogger Site. A major slough, trending from east to west, channeled through the present areas of the R Area, the landfill, and Froid and Taylor Roads and into the Wood Hogger Site. During construction of Naval Weapons Station SBD Concord, the slough was backfilled and Otter Sluice was constructed around the Wood Hogger and R Area Sites to channel water to Suisun Bay. By 1950 (with ongoing development of Naval Weapons Station SBD Concord), the fill was extended across the Wood Hogger Site from the northeastern corner to the southwestern corner, forming the storage yard at the Wood Hogger Site. Aerial photographs were used to identify the extent of fill areas.

From the early 1950s to the early 1970s, an incinerator was used to burn wood at the southwestern corner of the Wood Hogger Site. The concrete foundation of the incinerator remains on site. Between 1969 and 1973, dunnage and other wood scrap from Tidal Area operations were chipped using wood hogging equipment (IT 1992). Until about 1972, the chips were sold to the Fiberboard Company in Antioch, California (E&E 1983). When a market for the chips ended, the chips were deposited on the ground adjacent to the hogger. The chips were estimated to cover a 10-acre area at a thickness of up to 3.5 feet (IT 1992).

Some of the wood scraps chipped at the site came from ordnance crates returned from Vietnam. Most ammunition shipping crates used by the Marines in Vietnam, and some crates used by the Army, were treated with pentachlorophenol (PCP), a wood preservative that has since been identified as a contaminant of potential concern (COPC). The total amount of PCP-treated wood that may have been chipped and disposed of at the site was estimated at 20 tons (E&E 1983). The Wood Hogger Site was identified in the IAS because of the on-site burial of wood chips, which were suspected to contain PCP. Wood chips were not expected to have been burned because the incinerator and hogger were not operated at the same time.

The site consists of a paved dunnage or materials storage yard aligned from southwest to northeast across the site, with unimproved, open areas (that is, unpaved and with no constructed roads) north and south of the storage yard. A railroad spur is located at the northern edge of the storage yard. Aerial photographs from 1952 show this storage yard in use, with railroad tracks providing access from the northeastern corner of the site. Historical photographs and first-hand site observation indicated that a variety of wood and metal materials have been stored in sections of the yard at various times. The storage yard in the center of the site was identified as solid waste management unit (SWMU) 37 during the Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) confirmation study (CS) investigation (PRC 1997). Locations adjacent to this SWMU were investigated as part of the RI to assess it as a potential source of site chemicals.

1.1.4.3 Otter Sluice

There are no records of spills or industrial activities at Otter Sluice, and Otter Sluice has not been established as an Installation Restoration (IR) site. However, because of the proximity of Otter Sluice to the Tidal Area sites, including the landfill, the R Area, Froid and Taylor Roads, and the Wood Hogger, investigation of Otter Sluice was included in the RI to evaluate whether contaminated surface water or contaminated sediment may have migrated to Otter Sluice.

1.1.5 Physical Setting

Bay Mud is the predominant surface soil type Tidal Area. In developed areas, the Bay Mud is covered with fill soils, generally placed for the development of roads, railroads, or building pads. Based on available borehole data, the Bay Mud reaches a maximum thickness of about 40 feet in the northern part of the Tidal Area and thins southward toward Los Medanos Hills.

Groundwater conditions in the Tidal Area sites are detailed in a technical memorandum, "Confirmation Groundwater Sampling in the Tidal Area Sites" (Tetra Tech 1998) and are briefly summarized in this section.

The Tidal Area of Naval Weapons Station SBD Concord is characterized by an irregular piezometric surface and very thin (or absent) vadose zone. Surface water features in the Tidal Area act as local recharge and discharge zones for groundwater. Regionally, groundwater flows northward from Los Medanos Hills through the low-lying Tidal Area toward Suisun Bay. Surface water flows northward from Los Medanos Hills toward Suisun Bay in natural creeks, artificial ditches, canals, and culverts.

Groundwater at the Naval Weapons Station SBD Concord Tidal Area sites occurs in a shallow, unconfined water-bearing zone that is predominantly composed of silty clays. As Naval Weapons Station SBD Concord developed, site drainage was modified by digging drainage channels and filling both natural and manmade channels.

Otter Sluice is a manmade channel that flows along the western and southern sides of the Tidal Area sites at Naval Weapons Station SBD Concord. The sluice was designed to provide surface water drainage from the R Area and Wood Hogger Sites to Suisun Bay. A tide gate is located at the mouth of Otter Sluice. It is designed as a one-way drainage structure to promote the flow of water into Suisun Bay from Otter Sluice and prevent significant flooding of Otter Sluice from high tides in Suisun Bay. In recent years, the tide gate flap valve has fallen off its hinges and the gate no longer functions as a one-way valve. As a result, portions of the R Area Site have recently remained flooded throughout the year.

Groundwater measurements and a tidal influence study conducted in wells and piezometers over the years, before the flap valve for the tide gate failed at the mouth of Otter Sluice, demonstrated that groundwater during wet and dry seasons flowed toward the R Area, thus creating a groundwater sink. Based on these observations, the RI concluded that the Tidal Area sites were not hydrologically connected with Suisun Bay except for a narrow zone along Baker Road, where some tidal influence was observed.

1.1.6 Summary of Previous Investigations

The R Area, Froid and Taylor Roads Site, and the Wood Hogger Site were investigated simultaneously, and the results were issued in the same series of reports. Preliminary studies completed include an IAS (E&E 1983) and the site investigation (SI) (IT Corporation 1992). These studies recommended additional study and evaluation of the Tidal Area sites. As a result, remedial investigation work plans (PRC 1994, 1995) were prepared, field and laboratory work was conducted, and an RI was prepared. The most recent version of the RI is a revised draft final, completed in August 2003 (Tetra Tech 2003), but which per agreement with the U.S. EPA is now considered a draft document which will be revised to incorporate the results of this data gaps study.

The Navy's RI concluded that the Froid and Taylor Roads and Wood Hogger Sites were appropriate for no further action based on the low risk posed to human health and the environment. However, the agencies reviewed the draft final (now draft) RI report and prepared comments that identified data gaps in the investigation. As a result, the agencies requested further field investigation and evaluation. The Navy met with the agencies on November 20, 2003, and prepared responses to agency comments on January 4, 2004. As a part of planning the investigation to address the data gaps identified, the Navy prepared a proposed strategy, including a preliminary data quality objectives (DQO) analysis, and presented that information in a meeting with the agencies on May 14, 2004. Feedback from the meeting, combined with the Navy's January 4 responses to comments, forms the basis of the sampling proposed in this SAP.

One additional study was conducted in the vicinity of the Wood Hogger Site, the RFA CS (PRC 1997). The RFA CS evaluated the conditions at SWMU 37, which was surrounded by Site 11. The study recommended no further action at SWMU 37 because constituents were not detected at concentrations that posed unacceptable risk to human health or the environment.

1.1.7 Principal Decision-Makers

Principal decision-makers include the Navy and regulatory agencies. The lead regulatory agency for these sites is the U.S. EPA. Other principal decision-makers include DTSC, the California Regional Water Quality Control Board, the U.S. Fish and Wildlife Service, the State of

California Department of Fish and Game, and the National Oceanic and Atmospheric Administration. These decision-makers will use the data collected from this project, in conjunction with data generated previously during the RI, to evaluate whether further action is necessary to protect human health and the environment.

1.1.8 Technical or Regulatory Standards

The Navy assumes that the ER-M will be the action level applied to evaluate contaminant concentrations in surface sediments collected from the Tidal Area sites. ER-Ms and project-required reporting limits (PRRL) are compared in Appendix A.

1.2 PROJECT DESCRIPTION

The following sections discuss the objectives and measurements of the project. Table 2 presents a schedule of sampling, analysis, and reporting for this project.

TABLE 2: IMPLEMENTATION SCHEDULE FOR SAMPLING, ANALYSIS, AND REPORTING
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Milestone	Anticipated Date
Draft Sampling and Analysis Plan	July 13, 2004
Draft Final Sampling and Analysis Plan	November 8, 2004
Field Investigation	June 2, 2006
Draft Final Remedial Investigation Report	September 1, 2006
Final Remedial Investigation Report	October 3, 2006

1.2.1 Project Objectives

As stated in Section 1.1, the primary objective of this additional investigation is to address data gaps identified by the regulatory agencies at Tidal Area Sites 2, 9, and 11. The following field activities will be carried out as part of this investigation:

- Collect four step-out confirmation samples of surface sediment near FTSSL102, collected previously, to evaluate the presence of chlordane and DDT.
- Collect surface soil and sediment samples along nine transect lines to evaluate the nature and extent of mercury at the southwestern corner of the Wood Hogger Site.
- Collect confirmation samples at three locations where higher concentrations of mercury were detected in the past to confirm the former results and evaluate the variability of mercury concentrations.

1.2.2 Project Measurements

Surface sediment will be analyzed using EPA methodology, as described in Section 2.4.

1.3 QUALITY OBJECTIVES AND CRITERIA

The following sections present the DQOs and measurement quality objectives (MQO) identified for this SAP.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000b, 2000d). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project are presented in Table 3.

1.3.2 Measurement Quality Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively by collecting the quality control (QC) samples listed in Table 4. Specific precision and accuracy goals for these QC samples are listed in Appendix B.

The sections below describe each of the PARCC parameters and how they will be assessed within this project.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD):

$$RPD = \frac{|A - B|}{(A + B)/2} \; x \; 100\%$$

where:

A = First duplicate concentration

B = Second duplicate concentration

TABLE 3: DATA QUALITY OBJECTIVES

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

STEP 1: State the Problem

Two data gaps have been identified:

1. Three pesticides (alpha chlordane, gamma chlordane, and DDT] were detected at concentrations above the ER-M at location FTSSL102 within the Froid and Taylor Roads site (Site 9). The ER-M_q was categorized in the baseline ecological risk assessment as a "medium high" priority. All other ER-M_qs calculated for Froid and Taylor Roads sediment were categorized as "lowest" or "medium to lowest" priority. The BERA concluded that the distribution of ER-M_qs across the site indicates little risk to populations of benthic invertebrates at Site 9. EPA suggested that further investigations or remedial actions, such as hot spot removal, are warranted at location FTSSL102 to address potential risk to benthic invertebrates at that location.
2. Uncertainty is associated with the extent and risk posed by mercury at the Wood Hogger (Site 11) because detection limits achieved for surface water samples were above AWQC and the results in sediment were highly variable. The highest concentration of mercury in sediment was detected at sample location WHSSB022 (18.5 mg/kg). A sample collected adjacent to that location (WHSSBA08) showed a mercury result of 0.44 mg/kg. The 50-fold differential between these adjacent samples illustrates the variability of sample results in the southwestern corner of the site, where the highest concentration of mercury was detected.

STEP 2: Identify the Decisions

1. Are alpha-chlordane, gamma-chlordane, or DDT present at concentrations above the ER-M at Site 9?
2. Are concentrations of mercury in surface sediment at Site 11 above the ER-M?

STEP 3: Identify Inputs to the Decisions

- Validated analytical results will be obtained for alpha-chlordane, gamma-chlordane, DDT, and mercury in sediments.
- Ecologic risk-based screening levels

STEP 4: Define Study Boundaries

- The lateral extent of the study area is defined as shown on Figures 3 and 4.
- Sampling is expected to take place in winter 2004 or spring 2005.

STEP 5: Develop Decision Rules

1. If alpha-chlordane, gamma-chlordane, or DDT is present at concentrations above the ER-M at the new Site 9 sample locations, then the results will be used to reevaluate the ecological risk in the vicinity of FTSSL102. Otherwise, no further action is required.
2. If concentrations of mercury in surface sediment at Site 11 are above the ER-M at Site 11, then the results will be used to reevaluate the ecological risk. Otherwise, no further action is required.

STEP 6: Specify Tolerable Limits on Decision Errors

The number of samples and sampling locations for conducting additional chemistry testing on soil and sediment samples are based on professional judgment. Specification of tolerable limits on decision errors through the use of standard statistical methods is not applicable to this sampling design.

STEP 7: Optimize the Sampling Design

The design was optimized using professional judgment and sampling biased to fill the data gaps identified. Sample design was not optimized using a statistical test.

Notes:

AWQC	Aquatic water quality criteria	ER-M	Effects range-median
BERA	Baseline ecological risk evaluation	mg/kg	Milligrams per kilogram
DDT	Dichlorodiphenyltrichloroethane	TDS	Total dissolved solids
DTSC	Department of Toxic Substances Control	TOC	Total organic carbon
EPA	U.S. Environmental Protection Agency	TSS	Total suspended solids

TABLE 4: QC SAMPLES FOR PRECISION AND ACCURACY
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

QC Type	Precision	Accuracy	Frequency
Field QC	None	Equipment Rinsate	1 per day per type of non-disposable sampling equipment
		Source Water Blank	1 per source
Laboratory QC	Relative percent difference	Method Blanks	Method Blank = 1/20 samples
		LCS or Blank Spikes	LCS or Blank Spikes = 1/20 samples
		Surrogate Standards Percent Recovery	Surrogate Standards = Every sample for organic analysis by gas chromatography

Notes:

LCS Laboratory control sample
QC Quality control

Field sampling precision is evaluated by analyzing field duplicate samples. However, because it is not practical to obtain true field duplicate samples, field duplicates will not be collected for this project.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be generated for all analytes. The results of the analysis of each MS/MSD pair will be used to calculate an RPD for evaluating precision.

1.3.2.2 Accuracy

A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$Percent\ \mathrm{Recov}ery = \frac{S - C}{T} \ x \ 100$$

where:

S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike

Appendix B presents accuracy goals for the investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis on the results of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Field blanks (if appropriate) and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability is exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

As discussed further in Section 4.2, completeness will also be evaluated as part of the data quality assessment process (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.2.6 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. PRRLs are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRRLs, which are established by Tetra Tech in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

1.4 PROJECT ORGANIZATION

Table 5 presents the responsibilities and contact information for key personnel involved in sampling activities at the Tidal Area. In some cases, more than one responsibility has been assigned to one person. Figure 6 presents the organization of the project team.

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for personnel working on site.

1.5.1 Health and Safety Training

Personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations (CFR) Part 1910.120(e). These requirements include: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. OSHA training will include a refresher course on ordnance and explosive waste (OEW). Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every field team will maintain current certification in the American Red Cross “Multimedia First Aid” and “Cardiopulmonary Resuscitation (CPR) Modular,” or equivalent. Personnel performing the sampling beneath the building will have confined space entry training.

Copies of contractor’s health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are maintained in project files.

TABLE 5: KEY PERSONNEL

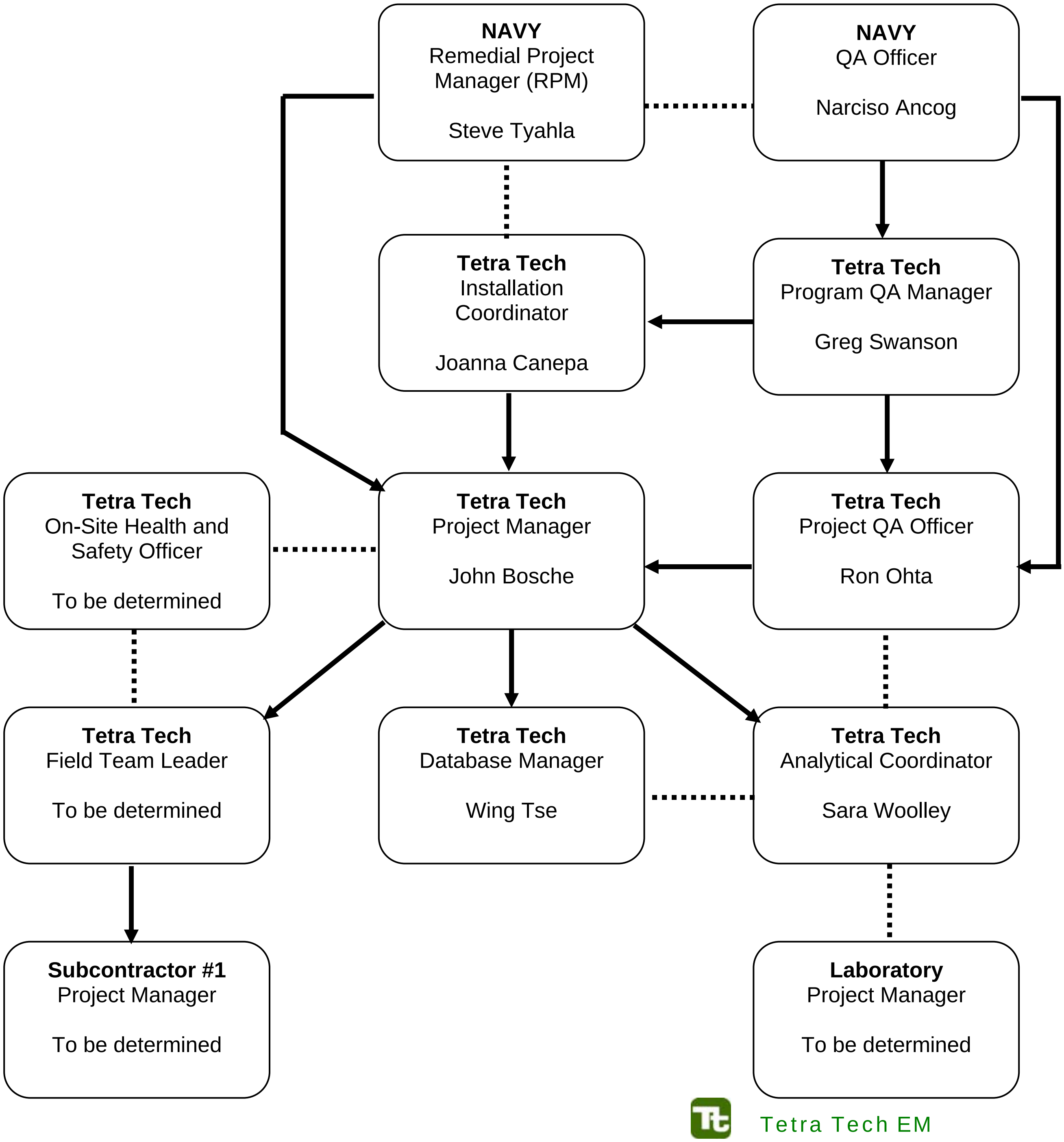
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
Steve Tyahla	Navy	Remedial project manager	Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management Actively participates in DQO process Provides management and technical oversight during data collection	Department of the Navy Naval Facilities Engineering Command Engineering Field Activity, West stephen.f.tyahla@navy.mil (650) 746-7451
Narciso A. Ancog	Navy	QA officer	Responsible for QA issues for all Southwest Division (SWDIV) environmental work Provides government oversight of Tetra Tech's quality assurance (QA) program Reviews and approves SAP and any significant modifications Has authority to suspend project activities if Navy quality requirements are not met	Naval Facilities Engineering Command, SWDIV, San Diego, CA narciso.ancog@navy.mil (619) 532-2540
Joanna Canepa	Tetra Tech	Installation coordinator	Responsible for ensuring that all Tetra Tech activities at this installation are carried out in accordance with current Navy requirements and Tetra Tech AECRU program guidance	Tetra Tech, San Francisco, CA joanna.canepa@ttemi.com (415) 222-8362
John Bosche	Tetra Tech	Project manager	Responsible for implementing all activities called out in delivery order (DO) Prepares or supervises preparation of SAP Monitors and directs field activities to ensure compliance with requirements of the SAP	Tetra Tech, San Francisco, CA john.bosche@ttemi.com (415) 222-8295
Greg Swanson	Tetra Tech	Program QA manager	Responsible for regular discussion and resolution of QA issues with Navy QA officer Provides program-level QA guidance to installation coordinator, project manager, and project teams Reviews and approves SAPs Identifies nonconformances through audits and other QA review activities and recommends corrective action	Tetra Tech, San Diego, CA greg.swanson@ttemi.com (619) 525-7188
Ron Ohta	Tetra Tech	Project QA officer	Responsible for providing guidance to project teams that are preparing SAPs Verifies that data collection methods specified in SAP comply with Navy and Tetra Tech requirements May conduct laboratory evaluations and audits	Tetra Tech, Sacramento, CA ron.ohta@ttemi.com (916) 853-4506

TABLE 5: KEY PERSONNEL (Continued)

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Name	Organization	Role	Responsibilities	Contact Information
To be determined	Tetra Tech	Field team leader	Responsible for directing day-to-day field activities conducted by Tetra Tech and subcontractor personnel	To be determined
			Verifies that field sampling and measurement procedures follow SAP	
			Provides project manager with regular reports on status of field activities	
To be determined	Tetra Tech	On-site safety officer	Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels	To be determined
			Conducts safety briefings for Tetra Tech and subcontractor personnel and site visitors	
			Can suspend operations that threaten health and safety	
Sara Woolley	Tetra Tech	Analytical coordinator	Responsible for working with project team to define analytical requirements	Tetra Tech, San Francisco, CA sara.woolley@ttemi.com (415) 222-8311
			Assists in selecting a pre-qualified laboratory to complete required analyses (see Section 2.4 of SAP)	
			Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics	
			Reviews laboratory data before they are released to project team	
Wing Tse	Tetra Tech	Database manager	Responsible for developing, monitoring, and maintaining project database under guidance of project manager	Tetra Tech, San Francisco, CA wing.tse@ttemi.com (415) 222-8326
			Works with analytical coordinator during preparation of SAP to resolve sample identification issues	
To be determined	Laboratory	Project manager	Responsible for delivering analytical services that meet requirements of SAP	To be determined
			Reviews SAP to understand analytical requirements	
			Works with Tetra Tech analytical coordinator to confirm sample delivery schedules	
			Reviews laboratory data package before it is delivered to Tetra Tech	
To be determined	Subcontractor	Project manager	Responsible for ensuring that subcontractor activities are conducted in accordance with requirements of SAP	To be determined
			Coordinates subcontractor activities with Tetra Tech project manager or field team leader	



Naval Weapons Station Seal Beach

Department of the Navy

FIGURE 6
PROJECT TEAM ORGANIZATION CHART

Tidal Area Data Gaps Investigation SAP

Before work begins at a specific hazardous waste project site, contractor's personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at a hazardous waste project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the site-specific HASP (Appendix C)

1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to contractor.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Safety Meeting Sign-Off Sheet" before they conduct on-site work. This briefing covers the topics described in Section 1.5.1 and is conducted by the Tetra Tech on-site health and safety officer (OHSO) or other qualified person.

1.5.3 Specialized Training and Certification Requirements

This projects requires no additional training or certification beyond the requirements defined in 29 CFR 1910.120(e).

1.6 Documents and Records

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.6.1 Field Documentation

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the DO number, the site name, and the names of subcontractors, the service client, and the project manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

The field team will also use the various field forms included in Appendix D to record field activities.

1.6.2 Summary Data Package

The subcontracted laboratory will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA 1999b, 2000a). The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and quality assurance and quality control (QA/QC) summaries. The case narrative will include the following information:

- Subcontractor name, project name, DO number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample identification (ID) numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional requirements for the summary data package are outlined in Table 6. The subcontracting laboratory will provide Tetra Tech with two copies of the summary data package within 28 days after it receives the last sample in the SDG.

1.6.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOWs (EPA 1999b, 2000a). Full data packages will contain all of the information from the summary data package and all associated raw data. Requirements for the full data package are outlined in Table 6. Full data packages are due to Tetra Tech within 35 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

The subcontracted laboratory will provide electronic data deliverables (EDDs) for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDDs. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDDs will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with Navy Environmental Data Transfer Standards (NEDTS). Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG
- All re-analysis, re-extractions, or dilutions reported for the SDG, including any associated with samples and the specified laboratory QC samples

1.6.4 Data Package Format

Electronic and hard-copy data must be retained by the Navy for a minimum of 3 and 10 years, respectively, after final data have been submitted. The laboratory subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

TABLE 6: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Summary Data Packages – Organic Analysis		Requirements for Summary Data Packages – Inorganic Analysis	
Section I	**Case Narrative**	**Section I**	**Case Narrative**
1.	Case narrative	1.	Case narrative
2.	Copies of nonconformance and corrective action forms	2.	Copies of nonconformance and corrective action forms
3.	Chain-of-custody forms	3.	Chain-of-custody forms
4.	Copies of sample receipt notices	4.	Copies of sample receipt notices
5.	Internal tracking documents, as applicable	5.	Internal tracking documents, as applicable
Section II	**Sample Results - Form I for the following:**	**Section II**	**Sample Results - Form I for the following:**
1.	Environmental samples, including dilutions and re-analysis	1.	Environmental samples, including dilutions and re-analysis
2.	Tentatively identified compounds (TIC) (VOC and SVOC only)		
Section III	**QA/QC Summaries - Forms II through XI for the following:**	**Section III**	**QA/QC Summaries** – Forms II through XIV for the following:
1.	System monitoring compound and surrogate recoveries (Form II)	1.	Initial and continuing calibration verifications (Form II)
2.	MS and MSD recoveries and RPDs (Forms I and III)	2.	PRRL standard (Form II)
3.	Blank spike or LCS recoveries (Forms I and III-Z)	3.	Detection limit standard (Form II-Z)
4.	Method blanks (Forms I and IV)	4.	Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5.	Performance check (Form V)	5.	Inductively coupled plasma (ICP) interference-check samples (Form IV)
6.	Initial calibrations with retention time information (Form VI)	6.	MS and post-digestion spikes (Forms V and V-Z)
7.	Continuing calibrations with retention time information (Form VII)	7.	Sample duplicates (Form VI)
8.	Quantitation limit standard (Form VII-Z)	8.	LCSs (Form VII)
9.	Internal standard areas and retention times (Form VIII)	9.	Method of standard additions (Form VIII)
10.	Analytical sequence (Forms VIII-D and VIII-Z)	10.	ICP serial dilution (Form IX)
11.	Gel permeation chromatography (GPC) calibration (Form IX)	11.	IDL (Form X)
12.	Single component analyte identification (Form X)	12.	ICP interelement correction factors (Form XI)
13.	Multicomponent analyte identification (Form X-Z)	13.	ICP linear working range (Form XII)
14.	Matrix-specific method detection limit (MDL) (Form XI-Z)		

TABLE 6: REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES (Continued)

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11, Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Requirements for Full Data Packages -- Organic Analysis

Sections I, II, and III **Summary Package**

Section IV **Sample Raw Data –** indicated form, plus all raw data

1. Analytical results, including dilutions and re-analysis (Forms I and X)
2. Tentatively identified compounds (TICs) (Form I — VOC and SVOC only)

Section V **QC Raw Data** – indicated form, plus all raw data

1. Method blanks (Form I)
2. MS and MSD samples (Form I)
3. Blank spikes or LCSs (Form I)

Section VI **Standard Raw Data –** indicated form, plus all raw data

1. Performance check (Form V)
2. Initial calibrations, with retention-time information (Form VI)
3. Continuing calibrations, with retention-time information (Form VII)
4. Quantitation-limit standard (Form VII-Z)
5. GPC calibration (Form IX)

Section VII **Other Raw Data**

1. Percent moisture for soil samples
2. Sample extraction and cleanup logs
3. Instrument analysis log for each instrument used (Form VIII-Z)
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

Requirements for Full Data Packages -- Inorganic Analysis

Sections I, II, III **Summary Package**

Section IV **Instrument Raw Data –** Sequential measurement readout records for ICP, graphite furnace atomic absorption (GFAA), flame atomic absorption (AA), cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:

1. Environmental samples, including dilutions and re-analysis
2. Initial calibration
3. Initial and continuing calibration verifications
4. Detection limit standards
5. Method blanks, continuing calibration blanks, and preparation blanks
6. ICP interference check samples
7. MS and post-digestion spikes
8. Sample duplicates
9. LCSs
10. Method of standard additions
11. ICP serial dilution

Section V **Other Raw Data**

1. Percent moisture for soil samples
2. Sample digestion, distillation, and preparation logs, as necessary
3. Instrument analysis log for each instrument used
4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results

1.6.5 Reports Generated

A remedial investigation report for the Tidal Area sites will be prepared at the conclusion of the field work and laboratory analysis. The report will include a comprehensive summary of the results of previous related investigations and field and sampling procedures for all sampling conducted at the site as part of the RI, including the data gaps sampling and analysis proposed in this SAP. The human health risk assessment and all previous sections of the former RI will be updated to incorporate the results of the additional sampling described in this SAP. In addition, the ecological risk assessment, which was formerly issued as a separate document, will be incorporated directly into the revised RI, either as an appendix or as a separate chapter. The revised RI will include updated conclusions and recommendations for each site.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following:

- Sampling Process Design (Section 2.1)
- Sampling Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)
- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Non-Direct Measurements (Section 2.9)
- Data Management (Section 2.10)

2.1 SAMPLING PROCESS DESIGN

The following subsections discuss the sample design of the data gaps sampling proposed in this SAP. The number of samples and description of locations are presented in Section 1.1.2 of this SAP.

2.1.1 Pesticides at Froid and Taylor Roads, Site 9

The sampling locations proposed to investigate the pesticide data gap at the Froid and Taylor Roads Site are described in Section 1.1.2.1 of this SAP. The design of the sampling program at this location is intended to evaluate the presence of pesticides in the vicinity of former sample location FTSSL102 and, if confirmed, to add data to the data set regarding the nature and extent of pesticides present. The proposed sample spacing and number of samples are based on professional judgment and discussions held with agency personnel on May 14, 2004.

2.1.2 Mercury in Wood Hogger, Site 11

The sampling locations proposed to investigate the mercury data gap at the Wood Hogger Site are described in Section 1.1.2.2 of this SAP. The design of the sampling program at this location is intended to evaluate the nature and extent of mercury at the southwestern corner of the Wood Hogger Site, particularly within Otter Sluice and on the banks of Otter Sluice.

Analytical results for mercury based on samples collected to date in the area vary in concentration. In addition to the sampling proposed along the nine transects, confirmation samples are also proposed in the immediate vicinity of samples collected previously that exhibited the highest concentrations. These samples are intended to confirm the high concentrations previously detected and to evaluate the variability in mercury concentrations at the site.

The proposed sample spacing and number of samples are intended to define the nature and extent of mercury contamination at the site. The proposed sampling pattern is biased to evaluate conditions near Otter Sluice and near locations of former samples that contained elevated concentrations of mercury. The sample design is based on professional judgment and discussions held with agency personnel on May 14, 2004.

Although the proposed sample design will provide data to evaluate the nature and extent of contamination, the sample design has not been developed to enable detailed statistical analysis of the data set. A larger number of samples would be necessary to generate a data set appropriate for detailed statistical analysis.

2.1.3 Rationale for Selecting Analytical Parameters

The rationale for addressing each data gap and the analytical suite selected as a results are presented in the following paragraphs and in Table 7.

Pesticides were selected for sampling and analysis at the Froid and Taylor Roads Site because the previous concentrations detected at sample location FTSSL102 exceeded ER-M values. No other data gaps have been identified at the Froid and Taylor Roads Site.

Mercury was selected for sampling and analysis because a number of previous samples in the southwestern corner of the Wood Hogger Site contain concentrations mercury in excess of the ER-M. No other data gaps have been identified at the Wood Hogger Site.

TABLE 7: PROPOSED DATA GAP SAMPLES, RATIONALE, AND ANALYSES
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Location Name	Analyses	Sample Identification No.	Sample Depth	Rationale
Four locations, see Figure 3	Pesticides	See Section 2.3.1	Surface Sediment	Step-out samples to confirm presence of pesticides near FTSSL102
Four locations, see Figure 3	Mercury	See Section 2.3.1	Surface Sediment	Step-out samples to confirm presence of mercury near WHSSB022
See Section 2.3.1	Mercury	See Section 2.3.1	Surface Sediments	Samples to evaluate nature and extent of mercury near Otter Sluice

2.1.4 Surveying

A professional land surveyor, licensed by the State of California, will survey the elevation of ground surface at each sample location to a precision of 0.10 foot and its horizontal location to 0.1 foot. The elevations will be surveyed relative to the 1929 National Geodetic Vertical Datum (1929 NGVD). The horizontal locations will be surveyed using the 1927 North American Datum (1927 NAD).

2.1.5 Underground Utilities Survey

Underground utilities will be surveyed to clear the locations of all soil borings before any intrusive activities begin. The survey will include water distribution piping, telecommunications lines, storm sewer lines, sanitary sewer lines, industrial wastewater lines, gas lines, fire fighting water lines, fuel product lines, and electrical lines.

2.1.6 Munitions and Explosives of Concern

The entire Tidal Area is located within an area potentially containing munitions and explosives of concern (MEC) as a result of the explosion at the munitions handling docks in 1944. Consequently, the locations for all intrusive sampling proposed in this SAP must be investigated and cleared for potential MEC using magnetometer screening before sample collection begins.

2.2 SAMPLING METHODS

This section describes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of investigation-derived waste (IDW).

2.2.1 Sampling Methods and Equipment

A disposable trowel will be used to collect surface sediment samples from 0 to 0.5 foot bgs. A representative sample will be collected, immediately transferred to an appropriate container, and chilled. It is possible that this technique will not be effective for the sediment samples to be collected from Otter Sluice. If this is the case, samples will be collected using either a hand corer or a Ponar grab sampler. The procedures for collection of sediments using either of these methods are described in detail in Tetra Tech SOP 006 (Appendix E).

2.2.2 Decontamination

It is expected that disposable equipment will be used to collect surface sediment samples; therefore, no equipment decontamination will be required. The possibility exists that this disposable equipment will not be effective in Otter Sluice. If non-disposable equipment is required, any equipment that may come in contact with sample media will be decontaminated following the practices listed in Tetra Tech SOP 002 “General Equipment Decontamination” (Appendix E). Nondisposable sampling equipment will be decontaminated before and after collecting each sediment sample for analysis. All water derived from decontamination will be collected and temporarily stored on site for characterization as IDW.

2.2.3 Management of Investigation-Derived Waste

No IDW will be generated during this investigation.

2.2.4 Sample Containers and Holding Times

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for samples prior to extraction and analysis are presented in Table 8, Protocol for Sample Collection.

2.3 Sample Handling and Custody

The sections below describe sample handling procedures, including sample identification and labeling, documentation, chain of custody, and shipping.

TABLE 8: PROTOCOL FOR SAMPLE COLLECTION

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analysis	Method	Matrix	Holding Time (From Date Sampled)	Container	Preservative
Pesticides	EPA 8081A	Sediment	14 days to extraction 40 days to analysis	8-ounce glass	Cool, 4C
Mercury	EPA 7471A	Sediment	28 days	8-ounce glass	Cool, 4C

Notes:

C Centigrade
EPA U.S. Environmental Protection Agency
mL Milliliter

2.3.1 Sample Identification

A unique sample identification number will be assigned to each sample collected during this project. The sample identification numbering system is designed to be compatible with a computerized data management system that includes previous results for samples collected at this installation. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering system indicates the DO and site numbers, the sampling type, and the location number. The numbering scheme is illustrated below.

Froid and Taylor Roads Site:

Location ID	Sample ID
See Figure 3	Same as Location ID

Wood Hogger Site
(location and sample ID numbers include transect number and sample numbers):

Location ID	Sample ID
WHS001A through WHS001I	Same as Location ID
WHS002A through WHS002I	Same as Location ID
WHS003A through WHS003I	Same as Location ID
WHS004A through WHS004I	Same as Location ID
WHS005A through WHS005I	Same as Location ID
WHS006A through WHS006I	Same as Location ID
WHS007A through WHS007I	Same as Location ID
WHS008A through WHS008I	Same as Location ID
WHS009A through WHS009I	Same as Location ID

2.3.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information, written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After it is labeled, each sample will be refrigerated or placed in a cooler that contains wet ice to maintain the sample temperature at or below 4 degrees Celsius.

2.3.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Tetra Tech personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink
- All entries will be legible
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout
- Any serialized documents will be maintained at Tetra Tech and referenced in the site logbook
- Unused portions of pages will be crossed out, and each page will be signed and dated

Section 1.6.1 includes additional information on how Tetra Tech will use logbooks to document field activities. The field team leader (FTL) is responsible for ensuring that sampling activities are properly documented.

2.3.4 Chain-of-Custody

The contractor will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record (Appendix F) also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins when samples are received and continues until samples are discarded. Laboratories analyzing samples must follow custody procedures at least as stringent as are required by the EPA CLP SOWs (EPA 1999b, 2000a). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons who delivered the samples, the date and time they were received, condition of the sample at the time it was received (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. This information should be entered into a computerized LIMS. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples that require special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

2.3.5 Sample Shipment

The following procedures will be implemented when samples collected during this project are shipped:

- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the shipping container. The airbill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The shipping container will be closed and taped shut with strapping tape around both ends. If the shipping container has a drain, it will be taped shut both inside and outside of the shipping container.
- Signed and dated custody seals will be placed on the front and side of each shipping container. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported within the taped sealed shipping container. When the shipping container is received at the analytical laboratory, laboratory personnel will open the shipping container and sign the chain-of-custody record to document transfer of samples.

Multiple shipping containers may be sent in one shipment to the laboratory. The outside of the shipping container will be marked to indicate the number of shipping container in the shipment.

2.4 ANALYTICAL METHODS

Sample methods, volume, preservation, and holding time requirements for these methods are specified in Table 8. Appendix A documents the PRRL for this project. Appendix B includes project-specific precision and accuracy goals for the methods.

The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. If problems occur in achieving the PRRLs, the laboratories will contact the contractor analytical coordinator immediately, and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the MDL will be reported with appropriate flags to indicate the greater uncertainty associated with these values.

Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following sections.

2.4.1 Selection of Analytical Laboratories

Laboratories for this investigation will be selected from a list of prequalified laboratories developed by Tetra Tech to support Navy contracts. Prequalification streamlines laboratory selection by reducing the need to compile and review detailed bid and qualification packages for each individual investigation. Prequalification also improves flexibility in the program by allowing analyses to be directed to a number of different capable laboratories with available capacity at the time samples are collected.

Tetra Tech's laboratory prequalification and selection process relies on (1) a standard procedure to evaluate and prequalify laboratories for work under the contract, and (2) the "Tetra Tech EM Inc. Laboratory Analytical Statement of Work" for Navy contracts (Tetra Tech 2002), a contractual document that specifies standard requirements for analyses that are routinely conducted. Tetra Tech establishes a basic ordering agreement that incorporates and enforces the laboratory SOW with each prequalified laboratory. Individual purchase orders can then be written for specific investigations. These aspects of laboratory selection are further described in the following sections, along with Tetra Tech's procedures for selecting laboratories when the laboratory SOW does not specifically address project-specific analytical methods or QC requirements.

2.4.1.1 Laboratory Evaluation and Prequalification

Laboratories that support the Navy either directly or through subcontracts are evaluated and approved for Navy use by the Naval Facilities Engineering Service Center (NFESC). Laboratories that support Tetra Tech under Navy contracts have been selected from the list of laboratories approved by NFESC. They further have been evaluated by Tetra Tech to assure that the laboratory can meet the technical requirements of the laboratory SOW and produce data of acceptable quality. The laboratories are evaluated in accordance with the NFESC *Installation Restoration Chemical Data Quality Manual* (IRCDQM) (NFESC 1999). The laboratory evaluation includes the following elements:

- **Certification and Approval.** Laboratories must be currently certified by the California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified. Laboratories must also have or obtain similar approval from NFESC. The California DHS ELAP certification and NFESC approval must be obtained before the laboratory begins work.

- **Performance Evaluation (PE) Samples.** Each laboratory must initially and yearly demonstrate its ability to satisfactorily analyze single-blind PE samples for all analytical services it will provide under Navy contracts. At its discretion, Tetra Tech may submit one or more double-blind PE samples at Tetra Tech's cost. When the results for the PE sample are deficient, the laboratory must correct any problems and analyze (at its own cost) a subsequent round of PE samples for the deficient analysis.

- **Audits.** Laboratories must initially and yearly demonstrate their qualifications by submitting to one or more audits by Tetra Tech. The audits may consist of (1) an on-site review of laboratory facilities, personnel, documentation, and procedures, or (2) an off-site review of hardcopy and electronic deliverables, or magnetic tapes. When deficiencies are identified, the laboratory must correct the problem and provide Tetra Tech with a written summary of the corrective action that was taken.

Appendix G provides a current list of subcontractor laboratories that have passed this evaluation program. Each laboratory was evaluated before it was added to the list, and each is reevaluated annually. If a laboratory fails to meet any of the evaluation criteria, it is removed from the list of approved laboratories.

2.4.1.2 Laboratory Statement of Work

The laboratory SOW establishes standard requirements for the analytical methods that are most commonly used under Navy contracts. For each method, the laboratory SOW specifies standard method-specific target analyte lists and PRRLs; QC samples and associated control limits; calibration requirements; and miscellaneous method performance requirements. The laboratory SOW also specifies requirements for standard data packages, formats for electronic data deliverables, data qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, temperature blanks, sample coolers, and custody forms and seals) that are expected of laboratories. The laboratory SOW incorporates Navy QA policy, as well as applicable EPA and state QA guidelines, as appropriate.

Tetra Tech's laboratory SOW is based on EPA CLP methods for volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls, metals, and cyanide. The laboratory SOW also addresses frequently used non-CLP methods for a variety of organic, inorganic, and physical parameters. Non-CLP methods include the methods published by EPA in SW-846 (EPA 1986) and in "Methods for Chemical Analysis of Water and Waste" (MCAWW) (EPA 1983); American Society for Testing and Materials (ASTM, now ASTM International) methods; and those published by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation in "Standard Methods for the Examination of Water and Waste Water (American Water Works Association 1999)." Laboratories on Tetra Tech's approved laboratory list can elect to provide all or a portion of the analytical services specified in the laboratory SOW.

As noted above, the laboratory SOW is incorporated into all laboratory subcontracts established for analytical services supporting Navy projects. Thus, the prequalified laboratories commit to meeting the requirements in the laboratory SOW during the contracting process before they receive samples. Tetra Tech reviews and revises the laboratory SOW regularly to incorporate new methods and requirements, modifications or updates to existing methods, changes in Navy QA policy or regulatory requirements, and any other necessary corrections or revisions.

2.4.1.3 Laboratory Selection and Oversight

After project-specific analytical and QA/QC requirements have been identified and documented in the SAP, the Tetra Tech analytical coordinator works closely with a Tetra Tech procurement specialist to select a laboratory that can meet these requirements. When project-specific analytical and QC requirements are consistent with Tetra Tech's laboratory SOW, the analytical coordinator identifies one or more prequalified subcontractor laboratories that are capable of carrying out the work. As part of this process, the analytical coordinator typically contacts the laboratories to discuss the analytical requirements and project schedule. The analytical coordinator then forwards the name of the recommended laboratory (or laboratories) to the Tetra Tech procurement specialist, who issues a purchase order for the work. When analytical requirements are consistent with Tetra Tech's laboratory SOW and multiple prequalified laboratories are capable of performing the work, a specific laboratory is typically selected based on workload and project schedule considerations.

Tetra Tech follows a similar procedure when project-specific analytical and QC requirements are nonstandard and differ from Tetra Tech's laboratory SOW. The analytical coordinator contacts analytical laboratories, beginning with Tetra Tech's prequalified list, to discuss the analytical and QA/QC requirements in the SAP and to assess the laboratories' ability to meet the requirements. In many cases, Tetra Tech works cooperatively with analytical laboratories to develop and refine appropriate QC requirements for nonstandard analyses or matrixes.

Additional laboratories are contacted if the analytical coordinator is unable to identify one or more prequalified laboratories that can accept the work. In general, the additional laboratories must be evaluated as described in Section 2.4.1.1 before they will be allowed to analyze any samples, although some steps in the evaluation may be waived for certain investigations and circumstances (for example, unusual analytes, urgent project needs, experimental methods, mobile laboratories, or on-site screening analyses). After additional laboratories have been identified, the analytical coordinator forwards their names to the procurement specialist. The procurement specialist prepares a solicitation package, including the project-specific analytical and QC requirements, and submits the package to the laboratories. The procurement specialist, in cooperation with the analytical coordinator and project manager, then evaluates the proposals that are received and selects a laboratory that meets the requirements and provides the best value to the Navy and Tetra Tech. Finally, the procurement specialist issues a purchase order to the selected laboratory that incorporates the project-specific analytical and QA/QC requirements.

After a laboratory has been selected, the analytical coordinator holds a kickoff meeting with the laboratory project manager. The kickoff meeting is held regardless of whether project-specific analytical and QA/QC requirements are consistent with Tetra Tech's laboratory SOW or are outside the SOW. The Tetra Tech project manager, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

2.4.2 Project Analytical Requirements

One or more prequalified subcontractor laboratories will analyze samples off site for this investigation. The laboratories will be selected before the field program begins based on their ability to meet the project analytical and QC requirements, as well as their ability to meet the project schedule. The analytical methods selected for this investigation standard EPA methods that are described in Tetra Tech's laboratory SOW.

This SAP documents project-specific QC requirements for the analytical methods selected. Sample volume, preservation, and holding time requirements are specified in Table 8. Requirements for laboratory QC samples are described in Table 4 and in Section 2.5. PRRLs for each method are documented in Appendix A. Appendix B includes project-specific precision and accuracy goals for the methods.

2.5 QUALITY CONTROL

The precision and accuracy of the chemical measurements of samples will be assessed through a combination of field and laboratory QC samples. Field QC samples and laboratory QC samples are discussed in the following sections.

2.5.1 Laboratory Quality Control Samples

The following types of laboratory QC samples will be used for this investigation:

- **Method blanks** will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

- **LCS** will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to determine the usability of the data.

- **Surrogate standards** consist of known concentrations of nontarget organic analytes that are added to each sample and method blank before samples are prepared and analyzed. The surrogate standard measures the efficiency of the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed by GC for volatile and extractable organic constituents.

2.5.1.1 Additional Laboratory QC Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed below.

- **MDL studies** determine the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL accounts for sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all air analyses. MDL studies will be conducted annually for soil matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than the required quantitation limits. The replicates will be extracted and analyzed in the same manner as the routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

- **Sample quantitation limits** (SQL) or practical quantitation limits, are PRRLs adjusted for the characteristics of individual samples. The PRRL is usually defined in the analytical method or in laboratory method documentation. The SQL accounts for changes in preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

- **Control charts** document data quality in graphic form for specific method parameters such as surrogate standards and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in evaluating whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Control charts are recommended for organic analyses. At a minimum, method blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Control charts should be updated monthly.

2.5.2 Field Quality Control Samples

QC samples are collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. Table 9 provides a summary of the types and frequency of collection of field QC samples.

TABLE 9: FIELD QC SAMPLES
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Sample Type	Frequency of Analysis	Matrix
Source Water Blank	1 per source of water used for the final decontamination rinse	Water
Equipment Rinsate	1 per day[a]	Water

Note: Field QC samples will only be collected if non-disposable sampling equipment is required.
a Tetra Tech anticipates one soil sampling event.

2.5.2.1 Field Duplicates

Field duplicate samples are collected at the same time and from the same source and then submitted as separate samples to the laboratory for analysis.

Although field duplicate soil samples are sometimes collected as soil samples from adjacent locations, such soil duplicate samples will not be collected for this project for two reasons. First, since adjacent soil samples incorporate some spatial variability, these samples cannot be used directly to assess sampling precision. Further, it is not practical to set QC limits for the RPD of such samples, which precludes the use of these samples for QC purposes. Second, while the spatial variability information that can be obtained from adjacent soil samples may be useful in assessing or implementing remedial options, no objectives relating to these data uses have been identified for this project. Rather, it has been determined that this type of spatial variability information will be obtained during subsequent investigations at this site, if required.

2.5.2.2 Equipment Rinsate Samples

Equipment rinsate samples demonstrate whether decontamination procedures are effective in removing contaminants from the field sampling equipment. The presence of contamination in equipment rinsate samples indicates that cleaning procedures were not effective, allowing for the possibility of cross-contamination. Equipment rinsate samples will be collected during soil sampling at a frequency of once per day of sampling. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free water will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

Equipment rinsate samples will be sent blind to the laboratory. During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

2.5.2.3 Source Water Blank Samples

One source water blank will be collected of the water used for the final decontamination rinse. Tetra Tech anticipates using only one source of water for the final decontamination rinse. The source water blank will be analyzed for all project analytes.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in the equipment manufacturer's literature or operating manual. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The FTL will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. Unscheduled testing, inspection, and maintenance should be conducted when the condition of equipment is suspect. Any significant problems with field equipment will be reported in the daily field QC report.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this investigation. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory’s QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures; the frequency and type of maintenance performed; and procedures for documenting maintenance.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 Instrument Calibration and Frequency

Field equipment, if used, will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference.

2.8 Inspection and Acceptance of Supplies and Consumables

Tetra Tech project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete Navy projects and are responsible for establishing acceptance criteria for these items.

Supplies and consumables can be received either at the Tetra Tech office or at the site. When supplies are received, the project manager or FTL will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order, and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in “Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers” (EPA 1992).

2.9 NONDIRECT MEASUREMENTS

No data for project implementation or decision-making will be obtained from nondirect measurements.

2.10 DATA MANAGEMENT

Field and analytical data collected from this project and other environmental investigations at NWS SBD Concord are critical to site characterization efforts, development of the comprehensive conceptual site model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into Tetra Tech’s database for NWS SBD Concord. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, (3) using with geographic information systems (GIS), and (4) transmitting in an electronic format compatible with NEDTS. The following sections describe Tetra Tech’s data tracking procedures, data pathways, and overall data management strategy for NWS SBD Concord.

2.10.1 Data Tracking Procedures

All data that are generated in support of the Navy program at NWS SBD Concord are tracked through a database created by Tetra Tech. Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in the Tetra Tech program, SAMTRAK. All data are filed according to the document control number.

2.10.2 Data Pathways

Data are generated from three primary pathways at NWS SBD Concord: data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the database for NWS SBD Concord. Data pathways must be established and well documented to evaluate whether the data have been accurately loaded into the database in a timely manner.

Data generated during field activities are recorded using field forms (Appendix D). The analytical coordinator or field team leader reviews these forms for completeness and accuracy.

Data from the field forms, including the chain-of-custody form, are entered into SAMTRAK according to the document control number.

Data generated during laboratory analysis are recorded in hardcopy and in EDDs after the samples have been analyzed. The laboratory will send the hardcopy and EDD records to the analytical coordinator. The analytical coordinator reviews the data deliverable for completeness, accuracy, and format. After the format has been approved, the electronic data are manipulated and downloaded into the database for NWS SBD Concord. Tetra Tech data entry personnel will then update SAMTRAK with the total number of samples received and number of days required to receive the data.

After validation, the analytical coordinator reviews the data for accuracy. Tetra Tech will then update the database for NWS SBD Concord with the appropriate data qualifiers. SAMTRAK is also updated to record associated laboratory and data validation costs.

2.10.3 Data Management Strategy

Tetra Tech's short- and mid-term data management strategies require that the database for NWS SBD Concord be updated monthly. The data consist of chemical and field data from Navy contractors, entered into an Oracle (Version 7.3) database. The database can be used to generate reports using available computer-aided drafting and design and contouring software. All electronic data from this database will be stored and maintained in a format compatible with NEDTS.

To satisfy long-term data management goals, the data will be loaded into the database at Tetra Tech for storage, further manipulation, and retrieval after laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms (Appendix D) that are reviewed for completeness and accuracy by the analytical coordinator or field team leader. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at Tetra Tech or Navy offices. Laboratories that generated the data will archive hardcopy data for a minimum of 10 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to Tetra Tech and Navy management.

3.1 ASSESSMENT AND RESPONSE ACTIONS

Tetra Tech and the Navy will oversee collection of environmental data using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, Tetra Tech and Navy responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

3.1.1 Field Assessments

Tetra Tech conducts field technical systems audits (TSA) on selected Navy projects to support data quality and encourage continuous improvement in the field systems that involve environmental data collection. The Tetra Tech QA program manager selects projects for field TSAs quarterly based on available resources and the relative significance of the field sampling effort. During the field TSA, the assessor will use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in the approved SAP are being implemented. Specific items that may be observed during the TSA include:

- Availability of approved project plans such as the SAP and HASP
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)

During the TSA, the Tetra Tech assessor will verbally communicate any significant deficiencies to the FTL for immediate correction. These and all other observations and comments will also be documented in a TSA report. The TSA report will be issued to the Tetra Tech project manager, FTL, program QA manager, and project QA officer in e-mail format within 7 days after the TSA is completed.

The Tetra Tech program QA manager determines the timing and duration of TSAs. Generally, TSAs are conducted early in the project so that any quality issues can be resolved before large amounts of data are collected.

The Navy QA officer may also independently conduct a field assessment of any Tetra Tech project. Items reviewed by the Navy QA officer during a field assessment may be similar to those described above.

3.1.2 Laboratory Assessments

As described in Section 2.4.1, NFESC assesses all laboratories before they are allowed to analyze samples under Navy contracts. Tetra Tech also conducts a pre-award assessment of each laboratory before they are placed on the approved list for performing work under Navy contracts (Appendix G). These assessments include (1) reviews of laboratory certifications, (2) initial and annual demonstrations of the laboratory's ability to satisfactorily analyze single-blind PE samples, and (3) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures, or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements. Tetra Tech also conducts an assessment when an approved laboratory has been selected for nonroutine analyses or when a laboratory that is not on the approved list must be used.

The Navy may audit any laboratory that will analyze samples on this project. The Navy QA officer will determine the need for these audits and typically will conduct the audits before samples are submitted to the laboratory for analysis.

3.1.3 Assessment Responsibilities

Tetra Tech personnel who conduct assessments will be independent of the activity evaluated. The Tetra Tech program QA manager will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the program QA manager, project QA officer, or senior technical staff with relevant expertise and experience in assessment.

When an assessment is planned, the Tetra Tech program QA manager selects a lead assessor who is responsible for:

- Selecting and preparing the assessment team
- Preparing an assessment plan
- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated
- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions.

After a TSA is completed, the lead assessor will submit an audit report to the Tetra Tech program QA manger, project manager, and project QA officer; other personnel may be included in the distribution as appropriate. Findings from the assessment will also be included in the quality control summary report for the project (Section 3.2.3).

The Navy QA officer is responsible for coordinating all audits that may be conducted by Navy personnel under this project. Audit preparation, completion, and reporting responsibilities for Navy auditors would be similar to those described above.

3.1.4 Field Corrective Action Procedures

Field corrective action procedures will depend on the type and severity of the finding. Tetra Tech classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described in Section 3.1.1, project teams are required to respond to deficiencies identified in TSA reports. The project manager, FTL, and project QA officer will discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the Navy of the problem and the corrective action taken

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for selecting and implementing the corrective action, and the completion dates for each corrective action. The project QA officer will use a status report to monitor all corrective actions.

The Tetra Tech program QA manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The program QA manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The program QA manager can also request the reanalysis of any or all samples and a review of all data acquired since the system was last in control.

3.1.5 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs:

control limits are exceeded, method QC requirements are not met, or sample holding times are exceeded. The laboratory will report out-of-control situations to the Tetra Tech analytical coordinator within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the Tetra Tech analytical coordinator. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. Tetra Tech will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

Tetra Tech will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, Tetra Tech and subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the field team leader and submitted to the project manager and to the Navy remedial project manager (RPM), if requested. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Monthly Status Report

The Tetra Tech project manager will prepare a monthly status report (MSR) to be submitted to the Tetra Tech's program manager and the Navy RPM. Monthly status reports address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, Tetra Tech will obtain similar information from subcontractors who are participating in the project and will incorporate the information within the MSR.

3.2.3 Quality Control Summary Report

Tetra Tech will prepare a QC summary report (QCSR) that will be submitted to the Navy RPM with the final report for the field investigation. The QCSR will include a summary and evaluation of QA/QC, including any field or laboratory assessments, completed during the investigation. The QCSR will also indicate the location and duration of storage for the complete data packages. Particular emphasis will be placed on determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining defensible data of acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called “outliers.” A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An independent third-party contractor will validate all laboratory data in accordance with current EPA national functional guidelines (EPA 1994, 1999c). The data validation strategy will be consistent with Navy guidelines. For this project, 90 percent of the data for contaminants of concern will undergo cursory validation and 10 percent of the data for contaminants of concern will undergo full validation. Requirements for cursory and full validation are listed below.

4.1.3.1 Cursory Data Validation

Cursory validation will be completed on 90 percent of the summary data packages received. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

4.1.3.2 Full Data Validation

Full validation will be completed on 10 percent of the full data packages received. The data reviewer is required to notify Tetra Tech and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries.

4.1.3.3 Data Validation Criteria

Table 10 lists the data validation QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from Table 10 will be consistent with the project-specific analytical methods referenced in Section 2.4 of the SAP.

4.2 Reconciliation with User Requirements

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met.

TABLE 10: DATA VALIDATION CRITERIA
Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analytical Parameter Group	Cursory Data Validation Criteria	Full Data Validation Criteria
Non-CLP Organic Analyses	Method compliance Holding times Calibration Blanks Surrogate recovery Laboratory control sample or blank spike Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Surrogate recovery Laboratory control sample or blank spike Compound identification Detection limits Compound quantitation Sample results verification Other laboratory QC specified by the method Overall assessment of data for an SDG

Notes:

CLP Contract Laboratory Program
QC Quality control
SDG Sample delivery group

To the extent possible, Tetra Tech will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (EPA 2000c). The DQA process includes five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative, Tetra Tech will systematically assess data quality and data usability. This assessment will include:

- A review of the sampling design and sampling methods to verify that they were implemented as planned and are adequate to support project objectives
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met

- A review of project-specific DQOs to determine whether they have been achieved by the data collected
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared with a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

REFERENCES

American Water Works Association. 1999. "Standard Methods for the Examination of Water and Wastewater, 20th Edition." January

California Air Resources Board (CARB). 1986. "Testing Guidelines for Active Solid Waste Disposal Sites."

Ecology and Environment (E&E). 1983. "Initial Assessment Study, Naval Weapons Station Concord, California." June.

IT Corporation (IT). 1992. "Draft, Site Investigation Report, Tidal Area Sites, Naval Weapons Station, Concord, CA." July.

Long, E.R. and L.G. Morgan. 1990. "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. US National Oceanic and Atmospheric Administration, Seattle, Washington, 175 pp.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management.* Volume 19, Number 1. Pages 81-97

Long, E.R., and D.D. MacDonald. 1998. "Recommended Uses of Empirically Derived, Sediment Quality Guidelines for Marine and Estuarine Ecosystems." *Human and Ecological Risk Assessment*. Volume 4, Number 5.

Naval Facilities Engineering Service Center (NFESC). 1999. "Navy Installation Restoration Chemical Data Quality Manual (IRCDQM)." Special Report SP-2056-ENV. September.

Occupational Safety and Health Administration (OSHA). 2003. "U.S. Department of Labor Occupational Safety and Health Administration, Permissible Exposure Limits." Available Online at: http://www.osha.gov/SLTC/pel. July.

PRC and Montgomery Watson (MW). 1993. "Tidal Area Landfill Confirmation Sampling Study, Naval Weapons Station, Concord, California."

PRC Environmental Management, Inc. (PRC). 1994. "Draft Final Work Plan, Volume I, Remedial Investigation/Feasibility Study [RI/FS] Tidal Area Sites, Naval Weapons Station Concord, California." December.

PRC. 1995. "RI/FS Tidal Area Sites Draft Final Work Plan, Volume II (QEA), Naval Weapons Station Concord, California." February.

PRC Environmental Management, Inc. (PRC). 1997. "Final Report, RCRA Facility Assessment Confirmation Study, Naval Weapons Station, Concord, California." Document Listing Information: Filing Code 003.06, Bar Code D000037618, Contract Task Order 044-0009. August 3.

Tetra Tech EM Inc. (Tetra Tech). 1998. "Technical Memorandum: Confirmation Groundwater Sampling in the Tidal Area Sites - Naval Weapons Station, Concord, California." March 19.

Tetra Tech. 2002. "Tetra Tech EM Inc. Laboratory Analytical Statement of Work." January.

Tetra Tech. 2003. "Revised Draft Final Remedial Investigation, Tidal Area Sites 2, 9, and 11, Naval Weapons Station Concord, California." (Now considered a draft document based on agreement between U.S. EPA and the Navy.)

Tetra Tech. 2004. "Final Record of Decision, Tidal Area Landfill Naval Weapons Station Seal Beach Detachment Concord, California." March

U.S. Environmental Protection Agency (EPA). 1983. "Methods for chemical analyses of water and wastes." Cincinnati, OH. EPA-600/4-79-020.

EPA. 1986. "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition." Cincinnati, Ohio. (revised December 1996)

EPA. 1992. "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers." OSWER Directive No. 9240.0-05A. April.

EPA. 1993. "Presumptive Remedy for CERCLA Municipal Landfill Sites." EPA 540/F-93/035. September.

EPA. 1994. "National Functional Guidelines for Inorganic Data Review." Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-94/013. February.

EPA. 1999a. "Compendium Method TO-15, Determination of Volatile Organic Compounds in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)." January.

EPA. 1999b. "U.S. EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration." Document Number OLM04.2. May.

EPA. 1999c. "National Functional Guidelines for Organic Data Review." Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-99-008. October.

EPA. 2000a. "U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration." Document Number ILM04.1. January.

EPA. 2000b. "Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/ G-4HW)." Office of Environmental Information. Washington, D.C. EPA/600/R-00/007. January.

EPA. 2000c. "Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/ G-9, QA00 Update." Office of Environmental Information. Washington, D.C. EPA/600/ R-96-084. July.

EPA. 2000d. "Guidance for the Data Quality Objectives Process, EPA QA/G-4." Office of Environmental Information. Washington, DC. EPA/600/R-96/055. August.

EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

Western Ecological Services Company (WESCO). 1995. "Qualitative Habitat Characterization Report, Tidal Area Sites, Naval Weapons Station Concord, California (Draft)." Prepared for PRC. March.

APPENDIX A
PROJECT-REQUIRED REPORTING LIMITS

TABLE A-1: ANALYTICAL REPORTING LIMITS

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analyte	PRRL	ER-M	PRRL Meets ER-M (Yes/No)?
Metals (mg/kg)			
Mercury	20	218	Yes
Pesticides (µg/kg)			
alpha-Chlordane	3	6	Yes
gamma-Chlordane	3	6	Yes
4, 4’-DDT	6	7	Yes

Notes:

µg/kg Micrograms per kilogram (parts per billion)
ER-M Effects range-median
mg/kg Milligrams per kilogram (parts per million)
PRRL Project-required reporting limit

APPENDIX B
METHOD PRECISION AND ACCURACY GOALS

TABLE B-1: PRECISION AND ACCURACY GOALS

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analyte	Sediment	
	% Recovery	RPD
Metals		
Mercury	70 to 130	35
Pesticides		
Spike Compound		
Dichlorodiphenyltrichloroethane	83 to 127	20
Surrogate Compounds		
Tetrachlorometaxylene	84 to 138	NA
Decachlorobiphenyl	59 to 113	NA

Notes:

NA Not applicable
RPD Relative percent difference

APPENDIX C
SITE-SPECIFIC HEALTH AND SAFETY PLAN (SHORT FORM) AND SAFE WORK PRACTICES – WORKING OVER OR NEAR WATER

Site Name: Concord Naval Weapons Station	**Site Contact:** John Bosche	**Telephone:** (415) 222-8295
Location: Tidal Area Sites 2, 9, and 11	**Client Contact:** Steve Tyahla	**Telephone:** (650) 746-7451
EPA I.D. No.: Not applicable	**Prepared By:** John Bosche	**Date:** June 2004
Project No. G1058.3.4.01.106.05	**Date of Proposed Activities:** Spring 2005	

Objectives:
All personnel working on this site must be trained in accordance with 29 CFR 1910.120 and must have medical clearance to work on a hazardous waste site.

The objective of this short form health and safety plan (HASP) is to list the site-specific hazards and the hazards controls to be used to ensure worker safety for the activities described below.

Site Type: *Check as many as applicable.*

☐ Active	☒ Industrial Waste	☐ Well field
☒ Inactive	☐ Landfill	☐ Underground storage tank
☒ Secure	☐ Confined space **(must use long form)**	☐ Unknown **(must use long form)**
☐ Unsecure	☐ Uncontrolled Waste **(must use long form)**	☐ Other *(specify)* ____________

Site Description/History and Site Activities:

The objective of the scope of work is to evaluate previously identified data gaps in the Tidal Area sites by collecting surface soil samples, and surface sediment samples. The soil or sediment samples from Site 9 will be analyzed for pesticides. Soil or sediment samples from the Wood Hogger Site and Otter Sluice areas will be analyzed for mercury.

The Tidal Area at Naval Weapons Station Seal Beach Detachment (NWS SBD) Concord is located within an area suspected of containing munitions and explosives of concern (MEC) as a result of an explosion in 1944 at the munitions handling docks. Collection of soil or sediment samples will be contingent on an evaluation of munitions and explosives of concern (MEC) at the site. Health and safety considerations associated with the clearing of the sample collection sites for MEC is not detailed in this HASP but will be covered in a separate health and safety plan addressing potential MEC at the sites.

Note: A site map, definitions, and additional information are provided on the last three pages of this form.

Waste Management Practices:

The Tidal Area Sites were proposed for no further action by the Navy based on the lack of risk to human health and the environment. Although data gaps were identified by the agencies and are the subject of the proposed sampling, risks to human health and the environment do not clearly trigger the need for action at the site. For example, carcinogenic risks to human health under residential exposure assumptions do not exceed 1×10^{-4} and but are greater than $1x\ 10^{-6}$. The risk to human health lies within the target risk range for the resident. Based on the results of the remedial investigation (RI), no waste management practices have been specifically identified that would pose unacceptable risk to human health.

Sample Media: ☒ Liquid ☒ Solid ☐ Sludge ☐ Gas

Waste / Chemical Characteristics:

	☐ Corrosive	☐ Oxidizer	☐ Flammable
☒ Toxic	☒ Explosive	☒ Volatile	☐ Radioactive
☐ Reactive	☐ Inert		☐ Other *(specify)* ________________

Chemical / Health Hazards of Concern:

☐ Explosion or fire hazard – monitor with combustible gas meter	☒ Inorganic chemicals (mercury)
☐ Oxygen deficiency – monitor with oxygen meter	☒ Organic chemicals (pesticides)
☐ Landfill gases – monitor with methane and hydrogen sulfide meter	☐ Petroleum Hydrocarbons
☐ Surface tanks	☐ Underground storage tanks
☐ Potential inhalation or skin absorption hazard that is immediately dangerous to life and health (IDLH) – **must use long form**	☐ Other *(specify)* ________________

Explosion or Fire Potential: ☐ High ☐ Medium ☒ Low ☐ Unknown

Radiological Hazards of Concern:

- ☐ Ionizing radiation (Radioactive materials, X-ray) **(must use long form)**
- ☐ Non-ionizing radiation (ultraviolet, lasers)

Safety Hazards of Concern: (Based on anticipated clean-up operations)

- ☐ Heavy equipment
- ☐ Pinch points
- ☐ Energized and rotating equipment (drill rig)
- ☐ Steam cleaning equipment
- ☐ Excavations
- ☐ Welding or torch cutting (hot work)
- ☐ Sharp objects
- ☐ Hazardous energy sources (electrical, hydraulic)
- ☐ Buried utilities
- ☐ Overhead utilities
- ☐ Suspended loads
- ☐ Buried drums
- ☒ Work over or near water (refer to Safe Work Practice # 6-05)
- ☐ Work from elevated platforms
- ☐ Manual lifting
- ☐ Other *(specify)* ______________________________

Physical Hazards of Concern:

- ☒ Heat stress
- ☐ Cold stress
- ☒ Slips, trips, falls on dry land and in a marine environment
- ☐ Illumination
- ☐ Vibration
- ☐ Noise
- ☒ Solar (sunburn)
- ☒ Unstable or steep terrain
- ☒ Other *(specify)* MEC. Must be checked prior to fieldwork

Biological Hazards of Concern:

- ☐ Poisonous plants (poison ivy, poison oak)
- ☐ Spiders (black widow or brown recluse spiders)
- ☐ Medical waste
- ☐ Snakes (rattlesnakes)
- ☐ Stinging insects (bees, wasps)
- ☐ Animals (feral dogs, mountain lions, etc.)
- ☐ Blood or other body fluids

Unexploded Ordnance:

- ☐ Unexploded Ordnance (UXO) **(must use long form)**
- ☐ Chemical Warfare Materials (CWM) **(must use long form)**
- ☐ Explosive ordnance waste (OEW) **(must use long form)**
- ☒ MEC evaluated under separate health and safety plan

Chemical Products Tetra Tech EMI Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- ☒ Alconox® or Liquinox®
- ☐ Hydrochloric acid (HCl)
- ☐ Nitric Acid (HNO_3)
- ☐ Sodium hydroxide (NaOH)
- ☐ Sulfuric Acid (H_2SO_4)
- ☐ Other *(specify)* ____________________
- ☐ Other *(specify)* ____________________
- ☐ Other *(specify)* ____________________
- ☐ Other *(specify)* ____________________
- ☐ Other *(specify)* ____________________
- ☐ Other *(specify)* ____________________

Chemicals Present at Site	Highest Observed Concentration (specify units and media)	PEL/TLV (specify ppm or mg/m^3)	IDLH Level (specify ppm or mg/m^3)	Symptoms and Effects of Acute Exposure	Photoionization Potential (eV)
Alpha chlordane	11 ug/kg	PEL = 0.5 mg/m^3 TLV = 0.5 mg/m^3	100 mg/m^3	Readily absorbed through the skin Acute: Causes convulsions; irritating to skin, eyes, and mucous membranes; Chronic: May cause damage to lungs, liver, and kidneys	NA
Gamma chlordane	12 ug/kg	PEL = 0.5 mg/m^3 TLV = 0.5 mg/m^3	100 mg/m^3	Readily absorbed through the skin Acute: Causes convulsions; irritating to skin, eyes, and mucous membranes; Chronic: May cause damage to lungs, liver, and kidneys	NA
DDT	15 ug/kg	PEL = 1 mg/m^3 TLV = 1 mg/m^3	500 mg/m^3	Readily absorbed through the skin Acute: Irritating to skin, eyes, and mucous membranes, affects the central nervous system; causes convulsions Chronic: Causes cancer in animals (possible human carcinogen); may cause damage to liver and kidneys	NA
Mercury (as alkyl mercury; e.g. methyl mercury)	18.5 mg/kg	PEL = 0.01 mg/m^3 TLV = 0.01 mg/m^3	2 mg/m^3	Readily absorbed through the skin Acute: Cause dysfunction of the central nervous system and kidneys; irritant of eyes, mucous membranes and skin; numbness and tingling of lips, hands, and feet; coordination, difficulty speaking, impairment of hearing, and emotional disturbances Chronic: Produces developmental effects in humans	NA

CARC = Carcinogenic	IDLH = Immediately dangerous to life or health	NE = Not established	STEL = Short term exposure limit
CNS = Central nervous system	mg/m^3 = Milligram per cubic meter	PEL = Permissible exposure limit	TLV = Threshold limit value
eV = Electron volt	NA = Not applicable	ppm = Part per million	U = Unknown

Field Activities Covered Under This Plan:

Task Description [1]	Type	Level of Protection: Primary		Level of Protection: Contingency		Date of Activities
1 Collect surface sediment and surface soil samples at NWS SBD Concord Tidal Area sites and in Otter Sluice	☒ Intrusive ☐ Nonintrusive	☐ C	☒ D	☐ C	☐ D	2005
2 Collect sediment samples in Otter Sluice from a boat or while standing at the bottom of the sluice during low tide	☐ Intrusive ☒ Nonintrusive	☐ C	☒ D	☐ C	☐ D	2005

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code	Task	Responsibilities
John Bosche, SF	1	Program Manager or Designated Leader: Directs project investigation activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary.
To be determined	1	SSC: Ensures that appropriate personal protective equipment (PPE) is available, enforces proper utilization of PPE by on-site personnel, suspends investigative work if he or she believes that site personnel are or may be exposed to an immediate health hazard, implements the health and safety plan, and reports any observed deviations from anticipated conditions described in the health and safety plan to the health and safety representative.
To be determined	1	Field Personnel: Complete tasks as directed by the program manager, field team leader, and SSC and follow all procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual.
To be determined	1	Alternate SSC: See above

[1] **Make copies of this page if more than 2 tasks are anticipated for the project.**

Protective Equipment: **(**Indicate type or material as necessary for each task; attach additional sheets as necessary)

Task: ☒ 1 ☐ 2		Task: ☐ 1 ☒ 2	
Level: ☐ C ☒ D		Level: ☐ C ☒ D	
☒ Primary	☐ Contingency	☒ Primary	☐ Contingency
RESPIRATORY	PROTECTIVE CLOTHING	RESPIRATORY	PROTECTIVE CLOTHING
☒ Not needed	☒ Not needed	☒ Not needed	☒ Not needed
☐ APR: ______	☐ Tyvek® coveralls: ______	☐ APR: ______	☐ Tyvek® coveralls: ______
☐ Cartridge: ______	☐ Saranex® coveralls: ______	☐ Cartridge: ______	☐ Saranex® coveralls: ______
☐ Escape mask: ______	☐ Coveralls: ______	☐ Escape mask: ______	☐ Coveralls: ______
☐ Other: ______	☐ Other: ______	☐ Other: ______	☐ Other: ______
HEAD AND EYE	GLOVES	HEAD AND EYE	GLOVES
☐ Not needed	☐ Not needed	☐ Not needed	☐ Not needed
☒ Safety glasses: ______	☐ Undergloves: ______	☒ Safety glasses: ______	☐ Undergloves: ______
☐ Face shield: ______	☒ Gloves: Nitrile	☐ Face shield: ______	☒ Gloves: Nitrile
☐ Goggles: ______	☐ Overgloves: ______	☐ Goggles: ______	☐ Overgloves: ______
☒ Hard hat: ______		☒ Hard hat: ______	
☐ Other: ______		☐ Other: ______	
FIRST AID EQUIPMENT	BOOTS	FIRST AID EQUIPMENT	BOOTS
☐ Not needed	☐ Not needed	☐ Not needed	☐ Not needed
☒ Standard First Aid kit	☒ Work boots: Steel-Toe/Steel	☒ Standard First Aid kit	☒ Work boots: Steel-Toe/Steel
☐ Portable eyewash	☐ Overboots: ______	☐ Portable eyewash	☐ Overboots: ______
OTHER		OTHER	
☐ (specify): ______		☒ (specify): Lifejacket	

Note: APR = Air purifying respirator

Monitoring Equipment: (Specify instruments needed for each task; attach additional sheets as necessary)				
Instrument	Task	Instrument Reading	Action Guideline	Comments
Combustible gas indicator model: Lantec® Gem 500 or equivalent	☐ 1 ☐ 2	0 to 10% LEL	No explosion hazard	☒ Not needed
		10 to 25% LEL	Potential explosion hazard; notify SSC	
		> 25% LEL	Explosion hazard; interrupt task; evacuate immediate area, notify SSC	
O_2 meter model: Lantec® Gem 500 or equivalent	☐ 1 ☐ 2	> 23.5% O_2	Potential fire hazard; evacuate immediate area	☒ Not needed
		23.5 to 19.5% O_2	Oxygen level normal	
		< 19.5% O_2	Oxygen deficiency; interrupt task; evacuate immediate area; notify SSC	
Photoionization detector model: ☐ 11.7 eV ☐ 10.6 eV ☐ 9.8 eV ☐ _____eV	☐ 1 ☐ 2	0 to 2 ppm above background	Level D	☒ Not needed
		>2 to 100 ppm above background	Level C	
		>100 ppm above background	Evacuate immediate area; notify SSC	
Flame ionization detector model:	☐ 1 ☐ 2	>0 to 5 ppm above background	Level D	☒ Not needed
		>5 to 50 ppm above background	Level C	
		>50 ppm above background	Evacuate site; notify SSC	
Respirable dust monitor model:	☐ 1 ☐ 2	Specify:	Specify:	☒ Not needed
Other: (specify):	☐ 1 ☐ 2			☒ Not needed

Notes: eV = Electron volt
O_2 = Oxygen
LEL = Lower explosive limit
ppm = Part per million
SSC = Site safety coordinator

Additional Comments:

Tetra Tech EMI site workers will contain and absorb any chemicals used or transferred on site.

Emergency Contacts:	**Telephone**
U.S. Coast Guard National Response Center	(800) 424-8802
InfoTrac	(800) 535-5053
Fire department	911
Police department	911
Tetra Tech EMI Personnel:	
Corporate Human Resource Manager: Norman Endlich	(703) 390-0626
Corporate Health & Safety Manager: Judith Wagner	(847) 818-7192
Office Health & Safety Coordinator: Will Warren	(415) 222-8293
Program Manager: John Bosche	(415) 222-8295
Site Safety Coordinator: To be determined	

Personnel Decontamination and Disposal Method:

Personnel will follow the U.S. Environmental Protection Agency's "Standard Operating Safety Guides" for decontamination procedures for Level D personal protection (with modified Level C contingency). The following decontamination stations should be set up in each decontamination zone:

- Segregated equipment drop
- Boot and glove wash and rinse
- Disposable glove, bootie, and coverall removal and segregation station
- Safety glasses and hard hat removal station
- Hand and face wash and rinse

If site conditions require upgrade to Level C, a station must be set up for respirator removal, respirator decontamination, and cartridge disposal.

All disposable equipment, clothing, and wash water will be double-bagged or containerized in an acceptable manner and disposed of in accordance with local regulations.

Medical Emergency:

Hospital Name: Mount Diablo Medical Hospital

Hospital Address: 2540 East St, Concord, CA

Hospital Telephone: Emergency - 911
General – (925) 682-8200

Ambulance Telephone: 911

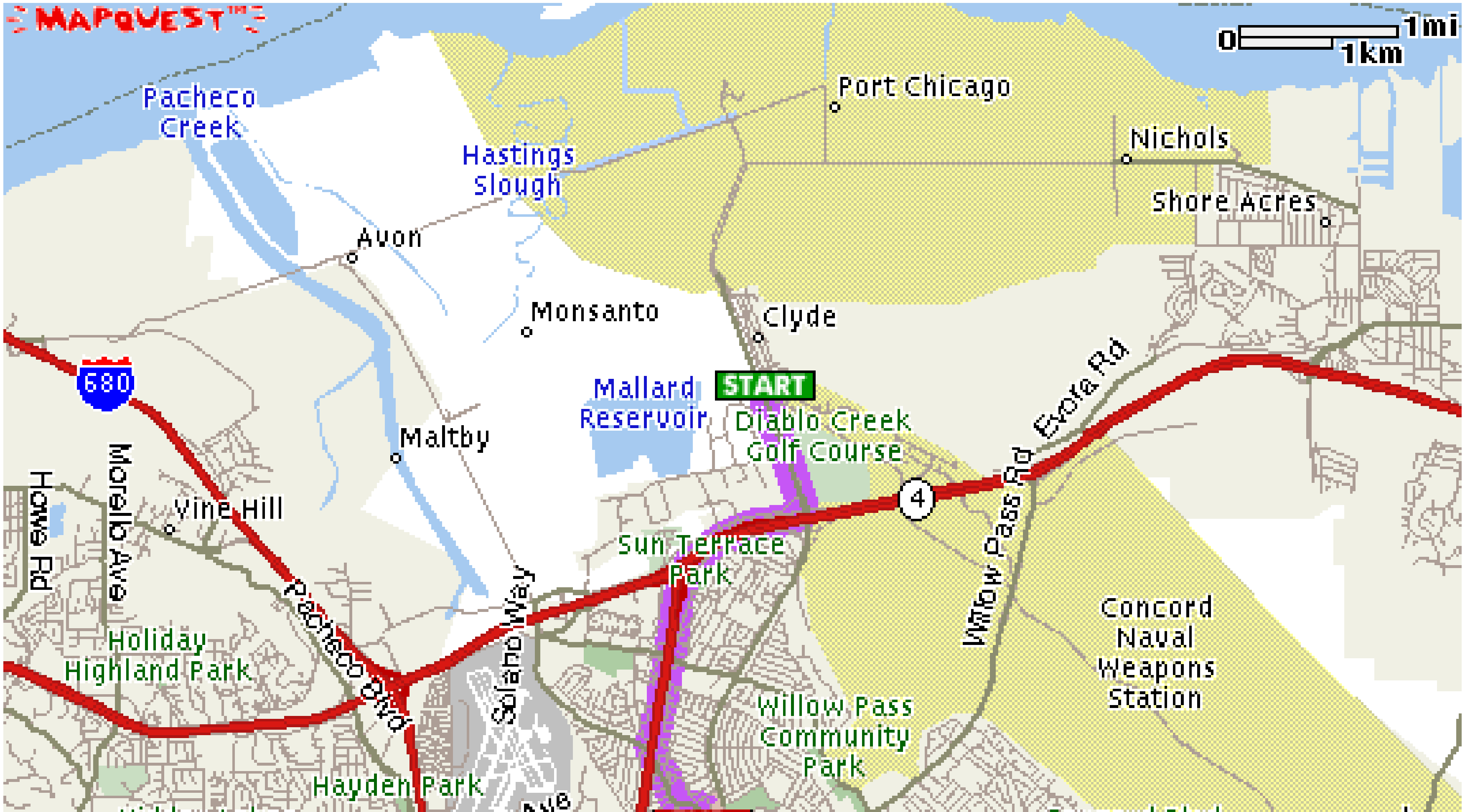
Route to Hospital: (see next page for route map)

1. Exit NWSSBD Concord and go South on PORT CHICAGO HWY
2. Take the CA-4 W ramp toward RICHMOND.
3. Merge onto CA-242 S toward OAKLAND/CONCORD. 1.6 miles
4. Take the SOLANO WAY exit toward GRANT ST. 0.1 miles
5. Take the ramp toward GRANT ST. <0.1 miles
6. Turn LEFT onto SOLANO WAY. <0.1 miles
7. SOLANO WAY becomes GRANT ST. 0.5 miles
8. Turn SHARP LEFT onto EAST ST. <0.1 miles

End at 2540 EAST ST CONCORD CA

Note: This page must be posted on site.

Hospital Route Map (if available):



Note: This page must be posted on site.

APPROVAL AND SIGN-OFF FORM

Project No. G1058.3.4.01.106.05

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator as well as procedures and guidelines established in the Tetra Tech EMI Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

APPROVALS: (Two Signatures Required)

Site Safety Coordinator	Date
Program Manager or Designee	6/14/04 Date

DEFINITIONS

Intrusive - Work involving excavation to any depth, drilling, opening of monitoring wells, most sampling, and Geoprobe® work

Nonintrusive - Generally refers to site walk-throughs or field reconnaissance

Levels of Protection

Level D – Hard hat, safety boots, and glasses, may include protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Level C – Hard hat, safety boots, glasses, and air purifying respirators with appropriate cartridges, **PLUS** protective clothing such as gloves, boot covers, and Tyvek® or Saranex® coveralls

Emergency Contacts

InfoTrac – For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center – For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Health and Safety Plan Short Form

- Used for field projects of limited duration and with relatively limited activities; may be filled in with handwritten text
- Limitations:
  - No Level B or A work
  - Limited number of tasks
  - No confined space entry
  - No unexploded ordnance work or radiation hazard

TETRA TECH EM, INC.

HEALTH AND SAFETY MANUAL

VOLUME III

SAFE WORK PRACTICES (SWP)

WORKING OVER OR NEAR WATER

SWP NO.: 6-5

ISSUE DATE: JULY 1998

REVISION NO.: 1

1.0 WORKING OVER OR NEAR WATER

This safe work practice (SWP) provides guidelines for working over or near bodies of water 3 or more feet deep or swiftly moving water. Workers will observe the requirements of the Occupational Safety and Health Administration (OSHA) specified in Title 29 of the *Code of Federal Regulations* (CFR), Part 1926.106, "Working Over or Near Water." The following sections discuss general procedures, underwater work, and cold water procedures.

2.0 GENERAL PROCEDURES

When working over or near water, the following precautions will be taken:

- All staff and team members must wear a personal flotation device (PFD) within 15 feet of a water body. Personnel will be provided with U.S. Coast Guard (USCG)-approved life jackets or work vests. The PFD should be Class III, which will support the head of an unconscious person above water.
- Life jackets and work vests will be inspected before each use.
- A USCG-approved life-saving skiff will be available.
- Under no circumstances will team members enter water bodies without protective clothing such as rubber boots or waders.
- At least one person will remain on shore as a look-out.

If a team member falls into the water, under no circumstances should another team member enter the water to rescue the person in the water. If possible, a branch, paddle, pole, or similar object should be extended to the person in the water. When the person in the water grabs the extended item, they should be pulled toward the shore or boat. If the person is unconscious, the PFD, clothing, or hair should be hooked to pull the person toward the shore or boat. Once the person has been safely retrieved, necessary emergency medical procedures should be performed by qualified personnel. If none are necessary, the retrieved team member should change into dry clothing as soon as possible after any necessary personal decontamination.

3.0 UNDERWATER WORK

Underwater work should be performed in accordance with the procedures and guidelines of the Diving Safety Program (Document Control No. 2-15 in Volume I).

4.0 COLD WATER PROCEDURES

When the water temperature is below 45 °F, hypothermia is a serious risk. A person can lose feeling in the extremities within 5 minutes. All field staff members should be familiar with cold water survival techniques or should receive training from an American Red Cross-certified swimming instructor in cold water survival techniques when site conditions warrant such knowledge.

After a person has been rescued from cold water, he or she should change into dry clothes as soon as possible. If the person who has fallen into the water displays hypothermia symptoms, he or she should be treated immediately and taken to a medical facility. Under no circumstances should the hypothermia victim be given hot liquids because this could accelerate shock. Drinks no warmer than normal body temperature is acceptable. If symptoms are severe and evacuation to a medical facility cannot be quickly conducted, any wet clothing should be removed, the victim should be placed in blankets or sleeping bags in a sheltered location, and the rescuer should climb into the blankets or sleeping bag with victim to provide additional warmth. The victim should also be treated continuously for shock, elevating feet and monitoring the victim’s pulse and breathing rate.

If a team member falls into cold water, he or she should not remove any clothing while in the water because clothing provides additional insulation. Although clothing creates an added drag while swimming, the insulation outweighs the disadvantage of the additional drag. Each team member should carry a wool hat to place on his or her head in case he or she falls into the water. A wool hat, even when wet, provides good insulation for the head, where a large amount of body heat is lost.

APPENDIX D
FIELD FORMS

Tetra Tech EM Inc.
135 Main Street, Suite 1800
San Francisco, CA 94105
(415) 543-4880

Daily Tailgate Safety Meeting Form

Date: ______________________ Time: _______________ Job Number: ____________

Client: ______________________ Site Location: __________________________________

Scope of Work: ____

Safety Topics Presented

Planned Field Activities for the Day: ____

Protective Clothing/Equipment: ____

Chemical Hazards: ____

Physical Hazards: ____

Special Equipment: ____

Decontamination Procedures: ____

Other: ____

Emergency Procedures: ____

Hospital: _______________ Phone: ___________ Ambulance Phone: _________________

Hospital Address and Route: ____

Employee Questions/Comments: ____

Attendees

Name (Printed)	Signature

Meeting Conducted By:

Name (Printed) / Signature	Name (Printed) / Signature
Site Safety Coordinator	Project Field Manager

COMPLIANCE AGREEMENT (FORM HSP-4)

Project Name: ____

Project Number: ____

I have read and understand the health and safety plan indicated above and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Name	Signature	Employer	Date

Tetra Tech EM Inc.

ACCIDENT AND ILLNESS INVESTIGATION REPORT (FORM AR-1)

To: ______________________________
Subsidiary Health and Safety Representative

Prepared by: ______________________________

cc: ______________________________
Workers Compensation Administrator

Position: ______________________________

Project name: ______________________________

Office: ______________________________

Project number: ______________________________

Telephone number: ______________________________

Fax number: ______________________________

Information Regarding Injured or Ill Employee

Name: ______________________________

Office: ______________________________

Home address: ______________________________

Gender: M ☐ F ☐ No. of dependents: __________

____

Marital status: ______________________________

Home telephone number: ______________________________

Date of birth: ______________________________

Occupation (regular job title): ______________________________

Social security number: ______________________________

Department: ______________________________

Date of Accident: ______________________________

Time of Accident: ______________ a.m. ☐ p.m. ☐

Time Employee Began Work: ______________________________

☐ Check if time cannot be determined

Location of Incident

Street address: ______________________________

City, state, and zip code: ______________________________

County: ______________________________

Was place of accident or exposure on employer's premises? Yes ☐ No ☐

Information About the Incident

What was the employee doing just before the incident occurred? Describe the activity as well as the tools, equipment, or material the employee was using. Be specific. Examples include "Climbing a ladder while carrying roofing materials"; "Spraying chlorine from hand sprayer"; and "Daily computer key-entry".

What Happened? Describe how the injury occurred. Examples include "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; and "Worker developed soreness in wrist over time".

Tetra Tech EM Inc.

ACCIDENT AND ILLNESS INVESTIGATION REPORT (Continued)

Information About the Incident (Continued)

What was the injury or illness? Describe the part(s) of the body affected and how it was affected. Be more specific than "hurt," "pain," or "sore." Examples include "Strained back"; "Chemical burn, right hand"; and "Carpal tunnel syndrome, left wrist".

Describe the Object or Substance that Directly Harmed the Employee: Examples include "Concrete floor"; "Chlorine"; and "Radial arm saw". If this question does not apply to the incident, write "Not applicable."

Did the employee die? Yes ☐ No ☐ Date of death: ______________________

Was employee performing regular job duties? Yes ☐ No ☐

Was safety equipment provided? Yes ☐ No ☐ Was safety equipment used? Yes ☐ No ☐

Note: Attach any police reports or related diagrams to this report.

Witness (Attach additional sheets for other witnesses.)

Name: ______________________

Company: ______________________

Street address: ______________________

City: ______________________ State: __________ Zip code: __________

Telephone number: ______________________

Medical Treatment Required? ☐ Yes ☐ No ☐ First aid only

Name of physician or health care professional: ______________________

If treatment was provided away from the work site, provide the information below.

Facility name: ______________________

Street address: ______________________

City: ______________________ State: __________ Zip code: __________

Telephone number: ______________________

Was the employee treated in an emergency room? ☐ Yes ☐ No

Was the employee hospitalized over night as an in-patient? ☐ Yes ☐ No

ACCIDENT AND ILLNESS INVESTIGATION REPORT (Continued)

Corrective Action(s) Taken by Unit Reporting the Accident:

Corrective Action Still to be Taken (by whom and when):

Name of SulTech employee the injury or illness was first reported to: ______________________

Date of Report: __________________________ **Time of Report:** __________________________

I have reviewed this investigation report and agree, to the best of my recollection, with its contents.

______________________________ ______________________________
Printed Name of Injured Employee Telephone Number

______________________________ ______________________________
Signature of Injured Employee Date

The signatures provided below indicate that the appropriate personnel have been notified of the incident.

Title	Printed Name	Signature	Telephone Number	Date
Office Manager				
Project Manager				
Site Safety Coordinator or Office Health and Safety Representative				

Tetra Tech EM Inc.

ACCIDENT AND ILLNESS INVESTIGATION REPORT (Continued)

To Be Completed by the Subsidiary Health and Safety Representative

Classification of Incident:

☐ Injury ☐ Illness

Result of Incident:

☐ First aid only

☐ Days away from work

☐ Remained at work but incident resulted in job transfer or work restriction

☐ Incident involved days away and job transfer or work restriction

☐ Medical treatment only

No. of days away from work: ______________________________

Date employee left work: ______________________________

Date employee returned to work: ______________________________

No. of days placed on restriction or job transfer: ______________________________

OSHA-Recordable Case Number ______________

To Be Completed by Human Resources

Social security number: ________________

Date of hire: ______________________ Date of hire for current job: ________________

Wage information: $ ______________ per ☐ Hour ☐ Day ☐ Week ☐ Month

Position at time of hire: ________________

Current position: ______________________ Shift hours: ______________________

State in which employee was hired: __________

Status: ☐ Full-time ☐ Part-time Hours per week: ________ Days per week: ________

Temporary job end date: ______________________________

To Be Completed during Report to Workers Compensation Carrier

Date reported: ______________________ Reported by: ______________________

Confirmation number: ________________

Name of contact: ______________________________

Field office of claims adjuster: ____________

APPENDIX E
STANDARD OPERATING PROCEDURES

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 2

Last Reviewed: December 1999

RRiesing

Quality Assurance Approved

February 2, 1993

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles

- Alconox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

2. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

3. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

5. Remove disposable gloves and place them in plastic bag for disposal.

6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on-site before drilling operations begin, between borings, and at completion of the project.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting.

The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket using a stiff, long bristle brush and Liquinox or Alconox solution.

2. Steam clean the sampling equipment over the rinsate tub and allow to air dry.

3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.

4. Containerize all water and rinsate.

5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SLUDGE AND SEDIMENT SAMPLING

SOP NO. 006

REVISION NO. 3

Last Reviewed: January 2000

RRiesing

Quality Assurance Approved

May 18, 1993

Date

1.0 BACKGROUND

Sludges are semisolid materials ranging from dewatered solids to high-viscosity liquids. Sludges generally accumulate as residuals of water-bearing waste treatment or industrial process systems. Sludges typically accumulate in tanks, drums, impoundments, or other types of containment systems.

Sediments generally are materials deposited in surface impoundments or in natural waterways such as lakes, streams, and rivers.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for sampling sludge in open drums and shallow tanks (3 feet deep or less) and sediment in lakes, streams, and rivers.

1.2 SCOPE

This SOP applies to collection of sludge and sediment samples. It provides detailed procedures for gathering such samples with specific equipment.

1.3 DEFINITIONS

Gravity Corer: Metal tube with a tapered nosepiece on the bottom and a check valve on the top. The nosepiece reduces core disturbance during penetration. The check valve allows air and water to pass through the sampler during deployment and prevents sample loss (washout) during retrieval.

Hand Corer: Thin-wall metal tube with a tapered nosepiece, a “T” handle to facilitate sampler deployment and retrieval, and a check valve on top.

Ponar Grab Sampler: A clamshell-type metal scoop activated by a counter-lever latching system.

1.4 REFERENCES

American Public Health Association. 1975. "Standard Methods for the Examination of Water and Wastewater." 14th Edition. Washington DC.

U.S. Environmental Protection Agency (EPA). 1984. "Characterization of Hazardous Waste Sites -- A Methods Manual. Volume II -- Available Sampling Methods." Second Edition. EPA-600/A-84-076. December.

EPA. 1994. "Sediment Sampling." Environmental Response Team SOP #2016 (Rev. #0.0, 11/17/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The selection of sampling equipment and procedures should be based on project objectives and site-specific conditions such as the type and volume of sludge or sediment to be sampled, sampling depth, and the type of sample required (disturbed or undisturbed). The selected sampling equipment should be constructed of inert materials that will not react with the sludge or sediment being sampled.

The following equipment may be required to sample sludge or sediment:

- Plastic sheeting
- Field logbook
- Spoons or spatulas
- Stainless-steel scoop or trowel
- Gravity corer
- Ponar grab sampler
- Stainless-steel or Teflon® tray
- Hand corer
- Nylon rope
- Sample containers and labels
- Chain-of-custody and shipping materials
- Decontamination materials

2.0 PROCEDURES

This section provides general procedures for sampling sludge and sediment. Sections 2.1 through 2.4 specify the methods and equipment to be used for such sampling.

Sludge Sampling

Sludge can often be sampled using a stainless-steel scoop or trowel (see Section 2.1). Frequently sludge forms when components with higher densities settle out of a liquid. When this happens, the sludge may still have an upper liquid layer above the denser components. When the liquid layer is sufficiently shallow, the sludge may be sampled using a hand corer (see Section 2.2). Use of the hand corer is preferred because it results in less sample disturbance. The hand corer also allows for the collection of an aliquot of the overlying liquid. This prevents drying or excessive oxidation of a sample before analysis. The hand corer may also be adapted to hold a brass, polycarbonate plastic, or Teflon® liner.

A gravity corer may also be used to collect samples of most sludges and sediments (see Section 2.3). A gravity corer is capable of collecting an undisturbed sample that profiles the strata present in a sludge or sediment. Depending on the weight of the gravity corer and the density of the sludge or sediment, a gravity corer may penetrate the material up to 30 inches. If the layer is shallow (less than 1 foot), gravity corer and hand corer penetration may damage any underlying liner or confining layer. In such situations, a Ponar grab sampler may be used because it is generally capable of penetrating only a few inches (see Section 2.4).

Sediment Sampling

Sediment can be sampled in much the same manner as sludge; however, a number of additional factors must be considered. In streams, lakes, and impoundments, for instance, sediment is likely to demonstrate significant variations in composition.

For stream sediment sampling, the sampling location farthest downstream should be sampled first. Sediment samples collected in upstream and downstream locations should be obtained in similar depositional environments and, whenever possible, should be obtained from slow-moving pools. In addition, a sediment sample should be collected at approximately the same location as an associated aqueous sample. Aqueous samples should be obtained first to avoid collecting suspended particles that may result from sediment sampling. To avoid disturbing an area to be sampled, sampling locations in streams should always be approached from the downstream side.

Sediment samples collected from lakes and impoundments should also be collected at approximately the same locations as associated aqueous samples. As in stream sampling, aqueous samples should be collected first to avoid collecting suspended particles that may result from sediment sampling. Downgradient and background samples should be collected from similar depositional environments.

Exact sampling locations should be documented in field logbooks or on data sheets with respect to fixed reference points. In addition, the presence of rocks, debris, or organic material in the sludge or sediment to be sampled may preclude use or require modification of sampling equipment.

The following subsections specify methods for sludge or sediment sampling with specific equipment.

2.1 SAMPLING WITH A SCOOP OR TROWEL

Sludge or sediment samples may be collected with a simple scoop or trowel. This method is more applicable to sludge but can also be used for sediments, provided that the water is very shallow (a few inches). However, using a scoop or trowel may disrupt the water-sediment interface and cause substantial sample alteration. This method provides a simple, quick means of collecting a disturbed sample of sludge or sediment.

The following procedure can be used for sampling sludge or sediment with a scoop or trowel:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Carefully insert a precleaned scoop or trowel into the sludge or sediment and remove the sample. In the case of sludge exposed to air, remove the first 2 to 4 inches of material before collecting the sample.

4. When compositing a series of grab samples, combine the samples in a stainless-steel bowl or Teflon® tray.

5. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

6. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

7. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

8. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

9. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.2 SAMPLING WITH A HAND CORER

The hand corer (see Figure 1) is used in the same situations and for the same materials as those described for the use of a scoop or trowel (see Section 2.1). However, the hand corer may be used to collect an undisturbed sample that can profile any stratification resulting from changes in material deposition.

Some hand corers can be fitted with extension handles that allow collection of samples underlying a shallow layer of liquid. Most hand corers can be adapted to hold liners, which are generally available in brass, polycarbonate plastic, or Teflon®. A liner material should be chosen that will not compromise the intended analytical procedures.

The following procedure can be used for sampling sludge or sediment with a hand corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Position a precleaned hand corer above the sampling location. Carefully deploy the hand corer into the sludge or sediment using a smooth, continuous motion.

4. When the hand corer is at the desired depth, rotate the "T" handle and retrieve the hand corer using a single, smooth motion.

5. Remove the nosepiece and extract the sample. Place the sample on a clean stainless-steel or Teflon® tray.

6. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

7. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

8. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

9. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

10. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.3 SAMPLING WITH A GRAVITY CORER

A gravity corer (see Figure 2) can collect essentially undisturbed samples to profile strata that develop in sediment and sludge during the deposition process. Depending on the sediment or sludge density and the gravity corer's weight, the sampler typically can penetrate the sediment or sludge to a depth of 30 inches.

Gravity corers should be used carefully in open drums, shallow tanks, or lagoons with liners. A gravity corer could penetrate beyond the sludge or sediment layer and damage the liner material.

The following procedure can be used for sampling sludge or sediment with a gravity corer:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a precleaned gravity corer. Braided, 3/16-inch nylon line is sufficient; however, 3/4-inch nylon line is easier to grasp during hoisting.

4. Secure the free end of the line to a fixed support to prevent accidental loss of the gravity corer.

5. Position the gravity corer above the sampling location. Allow the gravity corer to fall freely through the liquid and penetrate the sludge or sediment layer.

6. Retrieve the gravity corer with a smooth, continuous lifting motion. Do not bump the corer, as this may result in some sample loss.

7. Remove the nosepiece from the gravity corer. Slide the sample out of the corer into a stainless-steel or Teflon® pan.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

10. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

11. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

12. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.4 SAMPLING WITH A PONAR GRAB SAMPLER

A Ponar grab sampler (see Figure 3) can be used to sample most types of sludges and sediments. Its penetration depth usually does not exceed several inches. The Ponar grab sampler, like other grab samplers, cannot collect undisturbed samples; therefore, this sampler should be used only after all overlying water samples have been collected.

The following procedure can be used for sampling sludge or sediment with a Ponar grab sampler:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

2. Affix a completed sample container label to the appropriate sample container.

3. Attach the required length of sample line to a precleaned Ponar grab sampler. Braided, 3/4-inch nylon line is recommended for ease in hoisting.

4. Measure the distance from the water surface or other reference point to the top of the sludge or sediment. Mark this measurement on the sample line. To avoid unnecessary disturbance of the sludge or sediment from lowering the Ponar grab sampler too quickly, it is recommended that a second mark be made on the sample line to indicate the proximity of the reference mark.

5. Open the Ponar sampler's jaws until they are latched. The jaws will be triggered if the Ponar sampler comes in contact with or is supported by anything other than the sample line. Tie the free end of the sample line to a fixed support.

6. Position the Ponar grab sampler above the sampling location. Lower the sampler until the proximity mark is reached. Then, slowly lower the Ponar grab sampler until it touches and penetrates the sludge or sediment.

7. Allow the sample line to slacken a few inches to release the latching mechanism that closes the sampler's jaws. As the jaws close, they scoop the sludge or sediment up into the sampler. More slack may be required when sampling in surface waters with strong currents.

8. Retrieve the sampler and release its contents into a stainless-steel or Teflon® tray.

9. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

10. If required, preserve the sample in accordance with SOP No. 016, Sample Container, Preservation, and Maximum Holding Time Requirements.

11. Ensure that a Teflon® liner is present in the sample container cap, if required. Secure the cap tightly on the sample container.

12. Complete all chain-of-custody documents, field logbook entries, and sample packaging requirements.

13. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

HAND CORER

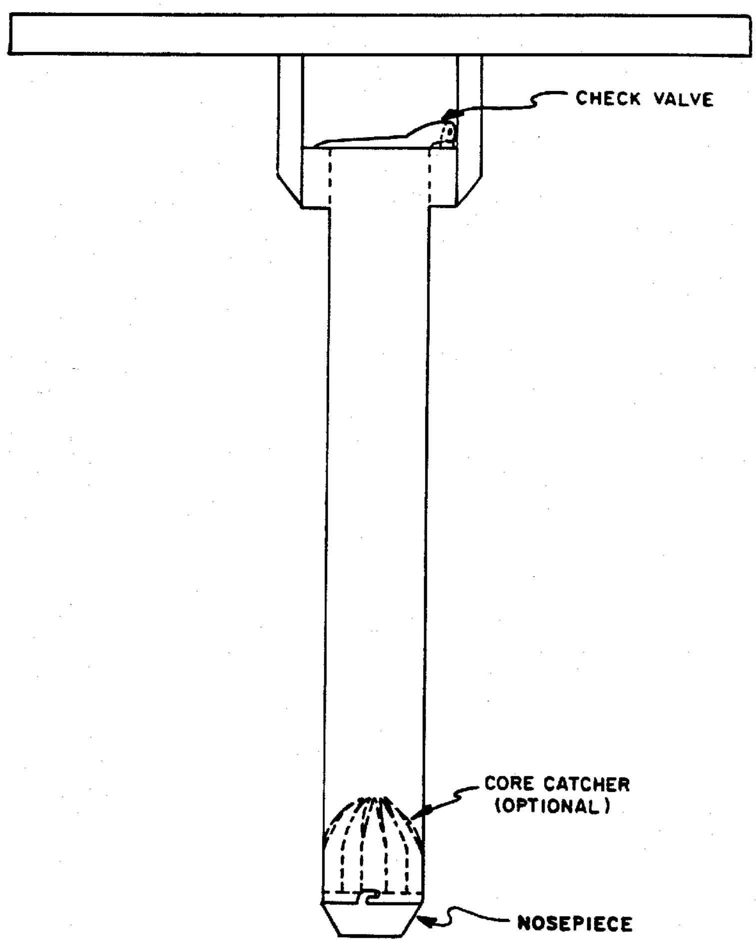


FIGURE 2

GRAVITY CORER

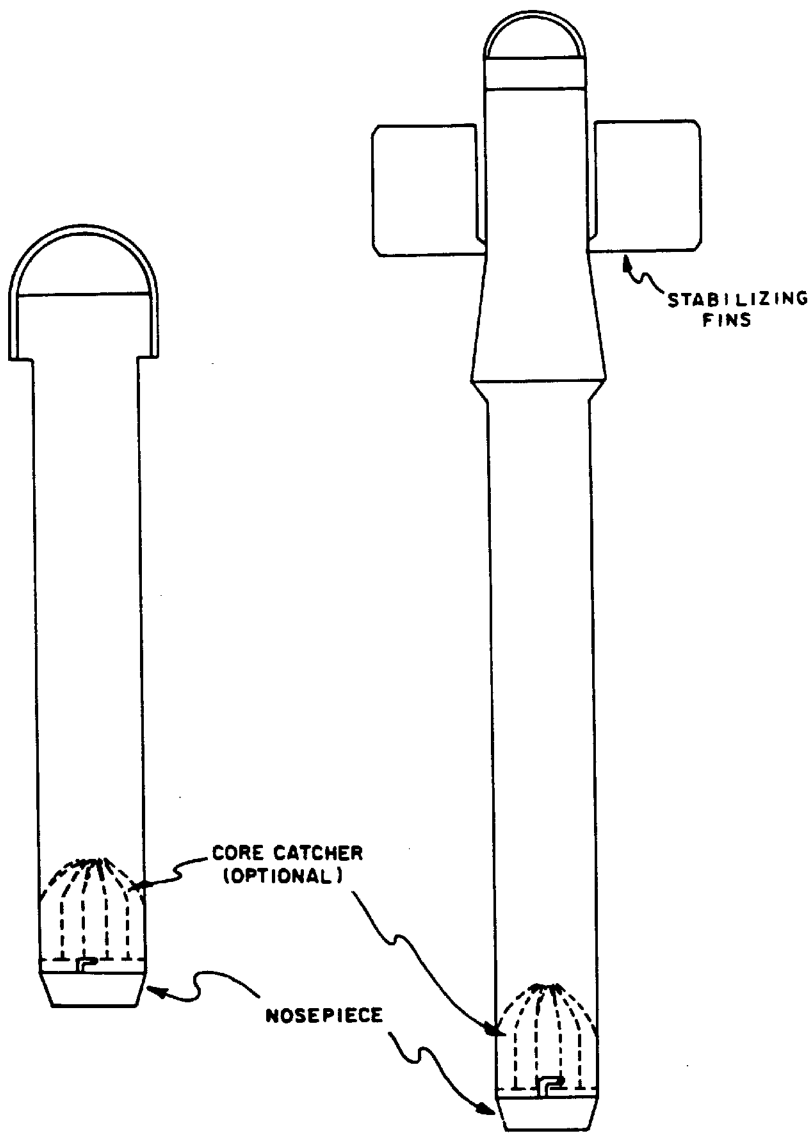
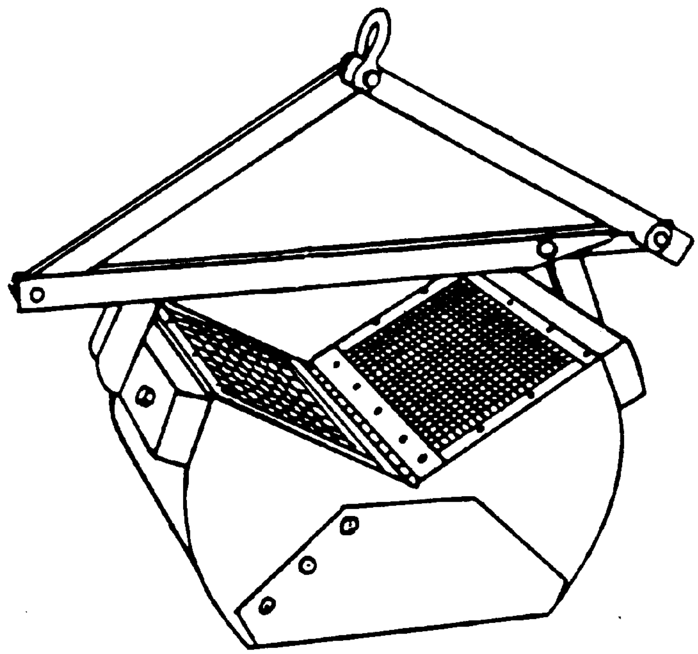


FIGURE 3

PONAR GRAB SAMPLER



APPENDIX F
EXAMPLE CHAIN-OF-CUSTODY FORM

Chain-of-Custody Record No. ____________

Page ____ of ____

Tetra Tech EM Inc.

135 Main Street, Suite 1800
San Francisco, CA
(415) 543-4880

	Laboratory PO#:	Laboratory:
Project Name:	Tetra Tech Technical Contact:	Field Samplers:
Project (CTO) Number:	Tetra Tech Project Manager:A37	Field Samplers' Signatures:

						No./Container Types								Preservative Added / Analysis Required															
Sample Identification No.	Sampling Location Identification No.	Date	Time	Matrix	MS/MSD	40-ml VOA	1-Liter Amber	1-Liter Poly	Brass Tube	Glass Jar				CLP VOA	CLP SVOA	CLP Pesticides/PCBs	CLP Metals	TPH-Purgeables	TPH-Extractables										

Signature	Name (Print)	Company Name	Date	Time
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

Turnaround Time/Remarks:

APPENDIX G
APPROVED LABORATORIES

TABLE G-1: TETRA TECH EM INC.-APPROVED LABORATORIES UNDER BASIC ORDERING AGREEMENT

Draft Data Gaps Sampling and Analysis Plan, Tidal Area Sites 2, 9, and 11
Naval Weapons Station Seal Beach Detachment Concord, Concord, California

Analytica Group	
Lab Address:	12189 Pennsylvania Street Thornton, CO 80241
Point of Contact:	Joe Egry / Mary Fealey
Phone:	(800) 873-8707 X103/X135
Fax:	(303) 469-5254
Business Size:	SWO
E-mail	mfealey@analyticagroup.com

Applied Physics and Chemistry Laboratory	
Lab Address:	13760 Magnolia Avenue Chino, CA 91710
Point of Contact:	Dan Dischner / Eric Wendland
Phone:	(909) 590-1828 X203/X104
Fax:	(909) 590-1498
Business Size:	SDB
E-mail	marketing@apclab.com

Columbia Analytical Services	
Lab Address:	5090 Caterpillar Road Redding, CA 96003
Point of Contact:	Karen Sellers / Howard Boorse
Phone:	(530) 244-5262 / (360) 577-7222
Fax:	(530) 244-4109
Business Size:	LB
E-mail	lkennedy@kelso.caslab.com

Curtis and Tompkins, Ltd	
Lab Address:	2323 Fifth Street Berkeley, CA 94710
Point of Contact:	Anna Pajarillo / Mike Pearl
Phone:	(510) 486-0925 X103/ X108
Fax:	(510) 486-0532
Business Size:	SB
E-mail	mikep@ctberk.com

EMAX Laboratories Inc.	
Lab Address:	1835 205th Street Torrance, CA 90501
Point of Contact:	Ye Myint / Jim Carter
Phone:	(310) 618-8889 X121/X105
Fax:	(310) 618-0818
Business Size:	SDB/WO
E-mail	ymyint@emaxlabs.com

Laucks Laboratories	
Lab Address:	940 S. Harney Street Seattle, WA 98108
Point of Contact:	Mike Owens / Kathy Kreps
Phone:	(206) 767-5060
Fax:	(206) 767-5063
Business Size:	SB
E-mail	KathyK@laucksslabs.com

Sequoia Analytical	
Lab Address:	1455 McDowell Blvd. North Suite D Petaluma, CA 94954
Point of Contact:	Michelle Wiita
Phone:	(707) 792-7517
Fax:	(707) 792-0342
Business Size:	LB
E-mail	

Notes:

DHS	California Department of Health Services
LB	Large business
SB	Small business
SDB	Small disabled business
SWO	Small woman-owned
WO	Woman-owned